STAR COMMUNITIES
Sustainability Tools for Assessing & Rating Communities

Columbia | SIPA
School of International and Public Affairs

Building the First Sustainability Rating System for Local Governments

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Preface

This report is the culmination of the Workshop in Applied Earth Systems Management for the Master of Public Administration in Environmental Science and Policy at Columbia University's School of International and Public Affairs. The team's consultation project for the STAR Community Index - a pioneering, strategic planning and performance management system that will offer local governments a road map for improving community sustainability.

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Executive Summary

STAR Communities works with local governments to measure and track sustainability progress. STAR is transforming how local governments will collect, aggregate and evaluate data. Using traditional and geospatial analysis, STAR will enable communities to set sustainability priorities and implement effective policies. STAR aims to accelerate the achievement of community sustainability goals by providing tools, networks and the incentive of friendly competition, all in an intuitive and user-friendly rating system.

STAR came to the Consultants with a comprehensive system built on a foundation of 70 objectives, each of which has clearly-defined community level outcomes that impact sustainability. The objectives are nested within nine separate goal areas, including Natural Systems; Planning and Design; Energy and Climate; Economic Prosperity; Employment and Workforce Training; Education, Arts, and Community; Health and Safety; Affordability and Social Equity; and Innovation and Process. The goal areas fall within the three pillars of sustainability: Environment, Economy, and Society. This framework is the basis for the STAR Community Index. The Index is STAR's roadmap for strategic planning and performance management within communities. The Consultants were tasked with developing and justifying a point allocation and weighting scheme for the STAR Community Index.

This report addresses the need for a credible point allocation system and weighting methodology for STAR. The Consultants developed a technically sound rating system that is easy to implement, comprehensive in scope, and attractive to communities of any size, scale, and character. Investigation into leading rating systems identified recurrent design elements and best practices and informed the design of a robust yet flexible rating system. Based on these best practices, three STAR-specific models were developed for weighting and allocating points to STAR objectives: a simple model, a rubric-based model, and an external scorecard model. In addition, interviews with rating system and sustainability experts provided context for community capacity, plausibility for adoption, system redundancies, and regional and size variations.

Based on the analysis of the case studies and the development of the three models, the Consultants developed a suite of recommedations for STAR. First, the point allocation structure should use a percentage (100-point) score. A 100-point system is an intuitive and accessible way for community officials and citizens to understand the STAR framework. The Consultants recommend that pillars and goal areas be weighted equally in order to emphasize the importance of STAR's integrated approach to sustainability; however, objectives should be weighted differently within goal areas to underscore the diversity of impacts that objectives have on sustainability. These weights should be determined through the application of a standardized rubric, created and implemented by STAR's network of experts. The rubric will utilize the experts' knowledge of the breadth and depth of the impact of an objective. To reward commnity progress towards sustainability, STAR should offer partial credit for objectives and establish rating thresholds based on the achievement of a certain number of points. The design of a user-friendly online platform and the streamlining of the number of objectives to reduce the workload for communities are also essential for implementation and ease of use of the Index. Finally, to establish and protect the STAR Communities brand, the Consultants recommended the inclusion of prerequisites and regionally-specific objectives to account for differences across the U.S. while defining a pathway for all communities towards sustainability.

Introduction

Over the past few years, definitions and frameworks developed for sustainability have been highly variable, leading to divergent approaches that feature different metrics for success. This has made it difficult for communities to share lessons learned and identify collaborative opportunities. When communities first started working on improving sustainability, they focused primarily on environmental aspects, such as green building, which tend to be more concrete than economic and societal aspects. ICLEI – Local Governments for Sustainability found that fewer than 50 percent of communities integrated economic and societal goals into their sustainability plans, thereby missing the opportunity for leveraging the synergies between local priorities, such as clean technology cluster development, green jobs creation, poverty alleviation, and greenhouse gas emissions reduction (ICLEI - Local Governments for Sutainability USA, 2010). In addition, recent surveys conducted by the National Association of Counties, National League of Cities, and the International City/County Manager's Association found many local sustainability programs are cash-strapped and understaffed (ICLEI - Local Governments for Sutainability USA, 2010).

In contrast, STAR Community Index (STAR) aims to provide a cost-effective and easy-to-use framework for sustainability that reduces the burden on program managers and fosters collaboration with sustainability professionals across the country. STAR provides a common language for sustainability and a clear path forward for all communities through the integration of economic, environmental, and societal strategies. The STAR Design Task Force is currently reviewing the Index framework and asked the Consultants to develop a credible and applicable point allocation structure and weighting methodology that incorporates STAR's values.

The challenge of this project was developing a point allocation and weighting system that is valid and reliable, so that STAR can identify and communicate the most important and impactful outcomes to communities. This task required a review of other rating systems and interviews with key experts to gain further insight and direction for further research. When researching a rating system, the following questions were asked: What is its conceptual basis? How comprehensive is it? How is a system balancing the distribution of credits attainable? What are its strengths and limits? How can these rating systems be used to inform the development of a comprehensive performance measurement tool? Using this information, three models were created and their strengths and weaknesses assessed. This led to the development of recommendations for STAR.

Finally, the Consultants organized a webinar with the STAR Steering Committee and Design Task Force and presented the recommendations. The team was also tasked to design a "STAR 101" education curriculum and a training strategy for small-groups (i.e. a single local government) and large-group training sessions to familiarize prospective communities with STAR and the related online tools. This material is included in Appendix C.

STAR Community Index

What is the STAR Community Index?

Sustainability Tools for Assessing & Rating Communities, or "STAR Communities" is a pioneering performance management and strategic planning system to be used by communities across the United States. STAR Communities combines a framework for sustainability, an online performance management system, and a rating system. STAR Communities will also foster the emergence of a network of government sustainability professionals and the sharing of innovative policies, incentives, and programs which will accelerate market uptake of this new sustainability framework. The online performance management system will be used to collect data and promote sustainability. In addition, benchmarking and progress measurement are essential policy tools to determine whether plans, policies, and investments are making an impact.

The STAR Community Index (STAR) is the sustainability rating system that encourages members to share best practices and facilitate collaboration. Through the application of a nationally standardized, yet flexible rating system, STAR provides a roadmap for measuring performance and enhancing sustainability for communities of all sizes in all regions in the U.S. STAR enables communities to gauge their sustainability progress relative to other communities without being a ranking system; all communities win when they strive to increase their sustainability. As local governments learn from each other, they will also benefit from friendly competition that spurs innovation.

At the heart of STAR is a voluntary, self-reporting framework that allows local governments to measure their progress in improving their sustainability across the interconnected dimensions of the environment, economy, and society. STAR is more than a checklist; instead, it focuses on the community-level outcomes associated with sustainability initiatives and provides robust data and geospatial tools to aid in decision-making at the municipal level.

STAR was developed by ICLEI – Local Governments for Sustainability, in collaboration with the U.S. Green Building Council (USBGC), the Center for American Progress (CAP), and the National League of Cities (NLC). Drawing from robust stakeholder engagement and local expertise, STAR responds to the diversity of local sustainability approaches and builds a constituency of early adopters. Stakeholders include cities, counties, governmental agencies, non-profit organizations, national associations, and private corporations. Nearly half of the committee members represent local governments to ensure that the program is being developed by and for local governments. The STAR Steering Committee governs system development and provides strategic direction for the scope, design, and function of the program. Ten STAR Beta Communities, ranging from Cranberry Township, PA to New York City, have collected data to inform the feasibility of the rating system. Using this information, the STAR Pilot Program is expected to launch in late 2012.

The STAR Framework

While many other sustainability indices focus exclusively on environmental performance, STAR Community Index integrates economic, environmental, and societal strategies in order to simultaneously address multiple goals. To this end, STAR organizes sustainability into three pillars: Environment, Economy, and Society. The pillars consist of eight goal areas pertaining to broad sustainability issues. A ninth goal area, Innovation and Process, was added to address issues that span all three pillars. STAR established Technical Advisory Committees (TACs) to develop specific objectives and performance measures for each goal area. While the exact number of objectives is still a work in progress, as of January 2012, there were 70 objectives that we will refer to in this report. Figure 1 provides a visual representation of the STAR framework. The complete STAR framework is presented in Appendix A.

Figure 1. STAR Framework

Environment
- Natural Systems
- Planning and Design
- Energy and Climate

Economy
- Economic Prosperity
- Employment and Workforce training

Society
- Education, Arts, and Community
- Health and Safety
- Affordability and Social Equity

STAR is a menu-based rating system, which means communities can pursue the most important or relevant objectives. This helps to address regional variability and differing priorities among communities by enabling them to customize their path to sustainability. Credit for objectives is achieved through two types of performance measures: community level outcomes and local government actions. Community level outcomes are desired goals of the objective, for example, a 80% reduction in greenhouse gas emissions by the year 2050. Full credit is received for an objective once the community level action has been met. Local government actions are the steps that a local government can take towards achieving the community level outcomes, such as the development of a climate change adaptation plan. Figure 2 summarizes these key terms.

Figure 2. STAR Key Terms

Term	Definition
Pillar	Environment, Economy, or Society
Goal Area	Title of desired outcome that a jurisdiction intends to achieve
Objective	A clear, desired outcome intended to move the community toward a goal
Purpose	Statement to clarify relevance, to provide context, and communicate the desired outcome
Performance Measures	Qualitative or quantitative, using relative or absolute metrics
Community Level Outcomes	Measurable indicators that depict a community's progress toward an objective
Local Government Actions	Preparatory steps effective toward achieving an objective

(ICLEI - Local Governments for Sustainability USA, 2010)

An example of how credits can be achieved for an objective within STAR is presented in Figure 3.

Figure 3. Illustration of the Objective Education Opportunities

Pillar	Society
Goal	Education, Arts, & Community
Objective	Education Opportunities
Purpose	To provide all people, from birth through adulthood, with access to high quality public education

Performance Measures
Community Level Outcomes
1. Four-year adjusted cohort high school graduation rate for all schools within the jurisdiction *Submittal Requirements:* Provide calculations of graduation rates on an annual basis using the four-year adjusted cohort method, divided by student group, school, school district and ZIP code census tract
Local Government Actions
1. Provide an annual school progress report *Submittal Requirements:* Annual school progress report
2. Use fiscal policy tools *Submittal Requirements:* Policy documents reflecting passage of budgets, bonds, and teacher recruitment and retention incentives

(ICLEI - Local Governments for Sustainability USA, 2011)

Interview with King County Representative

Richard Gelb is a member of both the STAR Steering Committee and the Design Task Force. He works for the King County, Washington Department of Natural Resources and Parks on waste management, water resources, and flood utility strategies. He is thus well positioned to discuss the necessary elements for a STAR point allocation system, as he is a liaison between the county's STAR Beta Communities and the program's head offices. In an interview, Mr. Gelb discussed the role of STAR's Beta Communities, ideas for an appropriate point allocation and weighting system, implications of geographical and community size disparities, and the future outlook of STAR. The highlights are summarized below:

- Any point allocation system must calibrate targets, outcomes, and objectives around real data.
- It is important to develop standard operation procedure for participants, so as not overburden communities with the excess workload of data collection.
- There are many crosscutting objectives across goal areas, thus, the system design ought to include a concept of "swim lanes" to address this aspect. He emphasized that a holistic and accessible representation of the objectives is crucial.
- It is essential to ensure point allocation takes into account the variation in regional and community topology; a nested system that facilitates access and sharing of information is favorable.
- STAR should be intriguing, enticing, and not intimidating to any size, region, or local government.

(Gelb, 2012)

Sustainability Rating Systems

Overview

In order to create a robust rating system for STAR, the Consultants chose six well-known and diverse rating systems to inform weighting models that could be applied to STAR, with each rating system built to achieve its own purpose analyzed accordingly. The following section presents these rating systems as case studies, each with a brief background and an explanation of their methodology.

The six case studies described below are the Index of Economic Freedom (IEF), the Environmental Sustainability Index (ESI), the Association for the Advancement of Sustainability in Higher Education's Sustainability Tracking, Assessment & Rating System (AASHE STARS), the U.S. Green Building Council's Leadership in Energy and Environmental Design for Neighborhood Development (USGBC LEED ND), the Environmental Performance Index (EPI), and the National Institute of Standards and Technology's Building for Environmental and Economic Sustainability (NIST BEES) online platform.

Case Studies

I. Index of Economic Freedom

Background

The Index of Economic Freedom (IEF) is a joint effort of the *Wall Street Journal* and the Heritage Foundation. First published in 1995, the IEF quantifies the freedom of economies throughout the world in order to rank them against each other. The IEF is considered to be an easily understood index that relies on simple mathematical computations based upon the monetization of impacts among different countries.

Methodology

In the IEF, countries are rated on a scale of 1-100, with 100 representing maximum economic freedom. The Index utilizes 10 equally weighted factors organized into 4 categories, presented in Figure 4. The multiple components that make up each factor are also weighted equally. Each factor is given a score from 0-100 in increments of 10, and the 10 factors are then averaged to produce a total score out of 100. The equal weighting and averaging methodology used in the IEF at an international level may be applicable to the first version of STAR.

Figure 4. IEF Framework

Regulatory Efficiency	**Rule of Law**
• Business Freedom	• Property Rights
• Labor Freedom	• Freedom from Corruption
• Monetary Freedom	
Open Markets	**Limited Government**
• Trade Freedom	• Fiscal Freedom
• Investment Freedom	• Government Spending
• Financial Freedom	

(Miller, Holmes, & Fuelner, 2012)

II. Environmental Sustainability Index

Background

The Environmental Sustainability Index (ESI) rates and ranks the ability of nations to protect the environment. By benchmarking environmental measurements, the ESI connects policymaking to empirical data and acts as an alternative to Gross Domestic Product (GDP) and the Human Development Index for assessing national progress towards sustainability. The ESI is an initiative of the Yale Center for Environmental Law and Policy (YCELP) and the Center for International Earth Science Information Network (CIESIN) at Columbia University, in collaboration with the World Economic Forum and the Joint Research Centre of the European Commission. The ESI was published between 1999 and 2005 (later replaced by the Environmental Performance Index) and was applied internationally; it provides an important example in understanding how various levels of data collection could be approached.

Methodology

The ESI is composed of 21 equally weighted indicators and is organized into 5 categories, presented in Figure 5. Each indicator builds on between 2- 12 data sets, for a total of 76 variables. Raw data for each variable was transformed to comparable scales using appropriate denominators (such as GDP or total population) and then aggregated. Uniform weighting was used because simple aggregation is transparent and easy to understand. After interviewing experts, no indicator seemed to have substantially higher or lower importance than the others. In addition, when statistical methods were used for weighting, equal values were suggested. Indicators receive a score from 0-100, with 100 representing maximum environmental protection. Variables within indicators are also weighted equally. For example, the two variables in the Water Quantity indicator (Freshwater Availability per Capita and Internal Groundwater Availability Per Capita) are both worth 50% of the indicator score. The 21 indicators are averaged to produce a final score out of 100. Again, the equal weighting and averaging methodology may be applicable to the first version of STAR.

III. AASHE STARS

Figure 5. ESI Framework

Reducing Environmental Stresses	Global Stewardship	Societal and Institutional Capacity
• Reducing Air Pollution	• Participation in International Collaborative Efforts	• Environmental Governance
• Reducing Population Pressure	• Greenhouse Gas Emissions	• Eco-Efficiency
• Reducing Waste and Consumption Pressure	• Reducing Trans-boundary Environmental Pressures	• Private Sector Responsiveness
• Reducing Water Stress		• Science and Technology
• Natural Resource Management		
• Reducing Ecosystem Stress		

Environmental Systems	Reducing Human Vulnerability
• Air Quality	• Environmental Health
• Biodiversity	• Basic Human Sustenance
• Land	• Reducing Environmental-Related Natural Disaster Vulnerability
• Water Quality	
• Water Quantity	

(Center for International Earth Science Information Network, Yale Center for Environmental Law and Policy, 2005)

Background

The Sustainability Tracking, Assessment & Rating System (STARS) is a transparent, self-reporting framework for colleges and universities to measure their sustainability performance. The Association for the Advancement of Sustainability in Higher Education (AASHE) developed STARS in 2006 with broad participation from the higher education community. Now in its fifth version, AASHE STARS has given ratings to over 150 institutions, ranging in size, type, and geographic location.

Methodology

AASHE STARS is composed of three broad categories with 17 subcategories, presented in Figure 6. There are 140 possible credits within the subcategories and extra 4 credits available for innovation outside of the established framework.

Credits are divided into two tiers: Tier 1 credits have measurable outcomes, such as greenhouse gas emission reduction, and Tier 2 credits are strategic outcomes or policies that are difficult to measure, such as a local offsets program. Tier 2 credits are worth 0.25 points, while Tier 1 credits are worth between 2-14 points. These weights were determined through a crowdsourcing activity, in which experts and users filled out a rubric of five questions, ranking the credits on a scale of 1-10. These assigned values are called "associative" because they measure the association between an objective and its impact. This associative value weighting methodology used by AASHE may be applicable STAR.

There are 100 points available in each of the three categories and an institution's score is calculated by averaging the percentage of applicable points. This is done to address variation among institutions and not to count credits that do not apply to an institution against its overall score. For example, institutions that do not have a campus fleet do not have to submit information for that credit under the Transportation subcategory. In the initial signup process, institutions fill out an "Institutional Boundaries" survey that determines what credits are applicable. AASHE STARS does not currently have prerequisites, so as to not create barriers to participation.

There are four levels of AASHE STARS ratings based upon threshold numbers of points: Bronze, Silver, Gold, and Platinum. Currently no institution has reached the Platinum level. A fifth rating, called Reporter, is also available in which an institution's score is not made public. This is a good option for institutions with limited capacity or those that would like to ease into the system. An institution's rating in effect for three years, at which time it must reevaluated.

Figure 6. AASHE STARS Framework

Operations	Planning, Administration, and Engagement	Education and Research
• Buildings	• Coordination and Planning	• Co-Curricular Education
• Climate	• Diversity and Affordability	• Curriculum
• Dining Services	• Human Resources	• Research
• Energy	• Investment	
• Grounds	• Public Engagement	
• Purchasing		
• Transportation		
• Waste		
• Water		

(Association for the Advancement of Sustainability in Higher Education, 2012)

Interview with AASHE STARS

An interview with Meghan Zahniser, Program Director at AASHE STARS, touched on the higher education rating system and the challenges it has faced since its inception. The program's similarities to STAR sets it apart from other sustainability models, offering valuable insight to good practices and lessons learned. According to Ms. Zahniser, AASHE STARS has prioritized "rating" over "ranking" and emphasized the creation of a non-exclusionary sustainability framework in which virtually any higher-level institution can participate. STARS has also grappled with the pros and cons of a tiered credit system, as certain credits of qualitative nature (Tier 2) have been given a lesser value based on the premise that they are not easily measurable. Some concern arose from the regional and size differences among participating institutions, but the adoption of applicable credits instead of mandatory credits appears to have successfully addressed this issue. Ms. Zahniser offered several key recommendations for STAR, mostly focusing on transparency, accessibility, expert-guided support for credit weighting, and opportunity for modifications over time.

(Zahniser, 2012)

IV. USGBC LEED ND

Background

The US Green Building Council (USGBC) established the Leadership in Energy and Environmental Design (LEED) rating system in 1998 to rate building sustainability. The LEED for Neighborhood Development (LEED ND) rating system was created in 2009 in collaboration with the Congress for the New Urbanism (CNU) and the National Resources Defense Council (NRDC). It is one of LEED's nine rating systems and specifically rates the sustainability of neighborhoods.

Methodology

The LEED ND point arrangement structure is based on 5 category areas, presented in Figure 7. The first three categories have 12 prerequisites and 54 credits, each worth 1-12 points for a total of 100 base points. The Innovation and Design and Regional Priority Credit categories provide 10 extra points for a maximum of 110 available points. All credit points are positive, whole numbers.

LEED has four levels of ratings based upon crossing a threshold number of points: Certified, Silver, Gold, and Platinum. The allocation of points among credits is weighted based on the potential environmental impacts and human benefits of each credit. LEED uses information from the U.S. Environmental Protection Agency's Tool for the Reduction and Assessment of Chemical and other environmental Impacts (EPA TRACI), as well as the National Institute of Standards and Technology's Building for Environmental and Economic Sustainability (NIST BEES), to assess the environmental impact of each credit area. Again, this weighting methodology based on associative values may be applicable to STAR. The impacts of the outcomes for the various categories, credits, and points were also evaluated against a reference neighborhood established by LEED ND as a standard of comparison.

Figure 7. LEED ND Framework

Base Credits	Extra Credits
• Smart Location and Linkage	• Innovation and Design Process
• Neighborhood Pattern and Design	• Regional Priority Credit
• Green Infrastructure and Buildings	
= 100 base points	= 10 extra points
*110 TOTAL POINTS	

(U.S. Green Building Council, 2011)

Interview with LEED

Chris Pyke, VP for Research at USGBC, discussed the process required to develop a robust rating system for LEED. He provided the background and perspective on the development of the LEED tools and the challenges faced in creating the new LEED 2012. Through multiple iterations and analysis, the LEED research and development team have made targeted improvements to address deficiencies within previous versions:

- The 2009 version utilized EPA TRACI impact categories because they were well defined, measured environmental impact, and linked to the life cycle analysis model. However, TRACI categories did not reflect LEED core activities and were duplicative when superimposed on LEED's own criteria. This resulted in the move towards an internal expert weighted system.

- LEED has worked hard to minimize double counting and credit overlap by formulating alternative compliance paths to achieve the same credit. Mr. Pyke concluded by saying that the USGBC has collaborated with other rating agencies in the past and is willing to disucss the application of the LEED methodology to STAR.

(Pyke, 2012)

V. NIST BEES

Background

The National Institute of Standards and Technology's Building for Environmental and Economic Sustainability (NIST BEES) is an online interactive software tool that allows users to select cost-effective, environmentally preferable building products. NIST BEES is targeted towards designers, builders, and product manufacturers. It evaluates environmental and economic performance data from 230 building products to assess their multidimensional life cycle impacts.

Methodology

The overall NIST BEES score consists of an environmental performance score and an economic performance score, presented in Figure 8. The environmental performance score is composed of the weighted sum of 12 impact category scores. These categories are primarily based on the EPA TRACI Life Cycle Impact Assessment (LCIA) methodology, with the addition of the Indoor Air Quality category. The economic performance score is composed of first costs and future costs, the sum of which comprises the life cycle cost.

NIST BEES can employ either assigned or user-defined weights to average the environmental and economic scores into the overall performance score. This is based on the value of environmental and economic performance to the individual user. The user defines the weights by selecting the relative importance of each impact category. They may also select a built-in set of weights derived from the EPA Science Advisory Board, judgments by a NIST BEES stakeholder panel, or an equal set of weights. Weights must sum up to 100. A "no weighting" option may also be selected, in which neither environmental nor economic performance is preferred. In this case, NIST BEES will compute and display only disaggregated performance results. The fact that NIST BEES is designed to rank building materials at a set point in time, and that the user has complete control over weighting, limits its ability to incorporate STAR values.

Figure 8. NIST BEES Framework

Environmental Performance	Economic Performance
• Global Warming	• First Cost
• Acidification	• Future Cost
• Eutrophication	
• Fossil Fuel Depletion	
• Indoor Air Quality	
• Habitat Alteration	
• Water Intake	
• Criteria Air Pollutants	
• Smog	
• Ecological Toxicity	
• Ozone Depletion	
• Human Health	

(National Institute of Standards & Technology, 2011)

VI. Environmental Performance Index

Background

The Environmental Performance Index (EPI) rates and ranks how close countries are to achieving established environmental policy goals. It provides analytic rigor and is a tool used to steer individual countries toward environmental sustainability. EPI is an initiative of the Yale Center for Environmental Law and Policy (YCELP) and the Center for International Earth Science Information Network (CIESIN) at Columbia University, in collaboration with the World Economic Forum and the Joint Research Centre of the European Commission. EPI was published in 2006, 2008, and 2010 and was derived from the benchmarking of the ESI, based on the feedback from more than 70 governments and hundreds of policymakers.

Methodology

The EPI averages 2 two equally weighted core environmental objectives, Environmental Health and Environmental Vitality, based on 10 policy categories, presented in Figure 9. Categories are based on 1-4 indicators, each representing an individual data set, for a total of 25 indicators. For each country, the indicators receive a proximately-to-target value representing the present outcome and target outcome. A value of 0 is the worst possible performance and a value of 100 is completely on target. Aggregation occurs at the indicator, category, and objective levels. Indicator values are aggregated based on their weights to produce category scores, averaged to produce the objective scores. The two scores are averaged together to create the total EPI score.

The equal weighting of the Environmental Health and Environmental Vitality objectives is based on the conclusion that both humans and nature matter the same amount. For each category, the weights of the indicators were determined on an individual basis using qualitative assessment and mathematical indices. For example, in the Fisheries category, the two indicators (Marine Trophic Index and Trawling Intensity) were subjectively given equal weight. In the Agriculture category, principal component analysis was applied to the three indicators, resulting in a weighting of 50% to Pesticide Regulation, 30% to Agricultural Subsidies, and 20% to Agriculture Water Intensity. This is a highly academic approach to a sustainability ranking system, and while it is very rigorous, it could be too difficult and costly an undertaking for STAR's initial version.

Figure 9. EPI Framework

Environmental Health:		
Environmental Burden of Disease	***Water Resources for Human Health***	***Air Quality for Human Health***
• Environmental Burden of Disease	• Access to Drinking Water	• Urban Particulates
	• Access to Sanitation	• Indoor Air Pollution
Environmental Vitality:		
Air Quality for Ecosystems	***Climate Change***	***Biodiversity and Habitat***
• Sulfur Dioxide Emissions	• Greenhouse Gas Emission/ Capita	• Biome Protection
• Nitrogen Oxide Emissions	• Electricity Carbon Intensity	• Critical Habitat Protection
• Volatile Organic Compound Emissions	• Industrial Carbon Intensity	• Marine Protected Area
• Ozone Exceedance		
Agriculture	***Water Resources for Ecosystems***	***Fisheries***
• Pesticide Regulation	• Water Quality Index	• Marine Trophic Index
• Agricultural Water Intensity	• Water Stress	• Trawling Intensity
• Agricultural Subsidies	• Water Scarcity Index	
Forestry		
• Growing Stock		
• Forest Cover		

(Center for International Earth Science Information Network, Yale Center for Environmental Law & Policy, 2010)

Interview with Natural Systems TAC Member

Mr. Jeffrey Raven is a member of the Natural Systems TAC, works as an adjunct professor at Columbia University's Graduate School of Architecture, Planning and Preservation, and heads RAVEN Architecture + Urban Design, LLC in New York City. In an interview he discussed the development of STAR and considerations for creating a comprehensive rating system for sustainability, summarized below:

- Desired outcomes operate on multiple spatial scales such as a building, site, neighborhood, city, sub-region, and region. To achieve objectives, the impact at each level must be identified in order to define performance measures. Also, the actors at the different levels must work in collaboration.

- The cross-cutting nature of objectives cannot be overlooked. For example, the Green Infrastructure objective is designated in the Natural Systems goal area in the Environment pillar as it delivers ecosystem services. However, it also relates to the other Environment pillar goal areas of Planning & Design and Energy & Climate, as well as the Equity pillar due to green infrastructure's impact on quality of life and public health.

- Although large municipalities like NYC generally have significant resources to devote towards achieving sustainability, smaller communities do not necessarily lack capcity; it actually may be more difficult for NYC to achieve certain objectives because of its size. Although STAR seeks to standardize sustainability, these differences ought to be taken into account.

(Raven, 2012)

Rating System Design Elements and Best Practices

In assessing the six case studies, several design elements emerged as the most important components of a robust yet flexible rating system. We later used these elements to develop three unique models for further guidance.

Level of Complexity:

Rating systems range from simple to complex, and the level of complexity has implications for their ease of understanding and implementation. In IEF and ESI, weighting is equal across all levels; while these models are easier to understand, an overtly simplistic model may not be able to accurately represent an issue as complex as sustainability. In some rating systems, complexity increases with depth when specific variables are analyzed individually. Systems like LEED ND and AASHE STARS are easy to understand and very functional at their top levels. Their categories and credits are clearly defined, as are the measures by which points are earned. However, the complexity of LEED ND and AASHE STARS lie in the expert calculations that are required to weight their credits. These methods require a team of experts that can perform rigorous scientific analysis of the STAR objectives, which may also prove difficult in a system that incorporates environment, economy, and society.

Comprehensiveness:

All rating systems strive to find a balance between comprehensiveness and accessibility. Many factors contribute to the limitation of a rating system's scope. For example, the 21 indicators in the ESI were chosen based on their statistical significance. However, some of the rating systems studied have been criticized for not displaying a complete range of issues. NIST BEES uses environmental and economic performance but ignores social factors (i.e. environmental justice). In the case of IEF, ESI, and EPI, data sourced from individual countries is not always consistent, and so statistical methods are used to fill in gaps. This makes clear the need for better data collection from countries. Also, some of the systems, like IEF, ESI, and EPI, award partial credit to acknowledge some level of progress. In contrast, LEED ND and AASHE STARS award credit on a binary basis (complete or incomplete) which may not capture the nuances of sustainability.

Qualitative and Quantitative Weighting:

Measures are weighted subjectively in some rating systems, as with the equal weighting in IEF, and some components of the EPI and ESI. Often qualitative assessment is transformed into numerical values to create a mathematical basis for weighting. But who makes these decisions and how reputable they are, and how well they work together, may be grounds for dispute. For example, in AASHE STARS, credit weighting was achieved through a crowdsourcing exercise performed by AASHE sustainability experts. In the same way, the self-selection option in NIST BEES' depends on individual sets of values which lead to subjective environmental and economic scores. Alternatively, LEED ND utilizes credible tools such as EPA TRACI and the NIST BEES expert weighting option, which are developed by government agencies entrusted with setting standards. NIST BEES measures environmental and economic performance on standard and reliable metrics like the International Organization for Standardization (ISO) 14040 and American Society for Testing and Materials (ASTM) standard life cycle cost method.

Prerequisites:

Some rating systems have prerequisites that require a base level of achievement. In these cases, prerequisites are distinguished as the most important evaluation criteria and are not factored into the weighting process or calculation of the score. LEED ND explicitly uses prerequisites, maintaining a high level of entry. AASHE STARS originally implemented prerequisites but found that it created a barrier to entry. The prerequisites were taken out but this move has been questioned

and there has been consideration to put them back in. Benchmarking tools like the IEF, ESI, and EPI do not utilize prerequisites because they measure what, if anything, countries have achieved.

Credit Applicability:

While rating systems provide an assessment standard, some criteria are not universally applicable across the board. Differences in size, region, and population can greatly influence scores. For example, in AASHE STARS, only credits that apply to institution type are factored into the score. The same is true for EPI; for example, information on fisheries is not factored into the scores of land-locked countries. In order to level the playing field, proportional data such as "per square mile" or "per capita" is used to measure the impact of indicators. Sometimes these demographic issues are considered in the analysis after scoring is complete. The ESI groups countries with similar features, like population density and ecosystem type, in order to compare them. As a result, it is clear that countries with the highest scores are those with the lowest population density and substantial national resource endowments.

One-Time Ratings vs. Renewed Ratings:

Finally, some rating systems deliver a score for a final product, such as LEED ND or NIST BEES. These scores are acquired once and apply to the life of the building. Others systems assess a participant's status at a certain point in time and reassess them periodically, such as IEF, ESI, AHSEE STARS, and EPI. However, updates to the methodologies make it difficult to definitively track individual progress over time, although participants can be re-ranked in order to observe trends. In response, the 2010 EPI system offers a pilot exercise focused on some of the indicators for which consistent time series data is available.

Modeling

By using the best practices and design elements presented in the sustainability rating system case studies, the Consultants created three models for weighting STAR objectives: a simple model, a rubric-based model, and an external scorecard model.

Model A: Simple Weighting

Overview

Model A was built with design assumptions specific to emphasizing and highlighting levels of simplicity and ease of entry for STAR Communities. It presents a way to allocate objective weights using a minimal amount of mathematical complexity. The model is based on equal weighting used in the Index of Economic Freedom (IEF) and the Environmental Sustainability Index (ESI).

Methodology

Objectives within a goal area are designed to be equal, so a weight factor of 1 is assigned to each objective. The weight factor of a goal area is the sum of its objective weight factors. In other words, a goal area's weight factor is the same as the number of its objectives. To determine the objective's weight, the objective weight factor is divided by the goal area weight factor. For a community to calculate an objective's score, the weight factor is multiplied by its completion value. A completion value ranges from 0% - 100%, where zero is no completion and one is full completion. The final goal area score is the sum of its objective scores.

For example, the Energy and Climate goal area in the Environment pillar has 8 objectives, so the goal area's total weight factor is 8, as shown in Figure 10. The weight of all objectives is equal to dividing 1 by 8 because they all share 1 as a weight factor. By weighting the objectives in this manner, each objective contributes 13% to the goal area score. For this illustration, we randomly assigned completion values to the objectives (either no completion or full completion) and multiplied them by each objective's 13% weighting. In this example, the Resource Efficient Buildings objective had full completion, so this community received the full 13% towards its goal area score. Objective scores were summed to obtain the total goal area score. In this example, the total goal score adds up to 38%. Therefore, the community achieved 38% of the Energy and Climate goal area.

Figure 10. Simple Model Example

Pillar	**Environment**				
Goal	**Energy & Climate**	**Weight Factor**	**Weight**	**Completed (1= Yes, 0 = No)**	**Score**
Objectives	Greenhouse Gas Mitigation	1	13%	0	0%
	Climate Adaptation	1	13%	0	0%
	Resource Efficient Buildings	1	13%	1	13%
	Greening the Energy Supply - Nontransportation	1	13%	1	13%
	Greening the Energy Supply - Transportation	1	13%	0	0%
	Industrial Sector Energy Use	1	13%	1	0%
	Environmental Impacts of Agriculure & Aquaculture	1	13%	0	13%
	Energy Use - Infrastructure	1	13%	0	0%
Total		8	100%	3	38%

**Note: All values are rounded to the nearest whole number or percentage*

Assessment

A summary of the strengths and weaknesses of the simple model is presented in Figure 11.

Strengths:

The simple mathematical process of Model A makes it relatively easy to understand, because equally weighted objectives within goal areas is an intuitive model framework. A weighting system that is easy to understand is considered a strength because municipal governments can quickly comprehend the weighting process, which facilitates entry into the system. The simple weighting framework is also advantageous because it allows for quick and easy implementation by STAR. The model allows for flexibility in the overall objective count. This would enable the easy addition or removal of objectives without resulting in significant mathematical changes across pillars. Eventually, it can be adapted into a more complex model with associative factors.

Equal weighting of objectives encourages community "buy-in" because communities can target objectives that are important to them and can acquire points by going after "low hanging fruit," or objectives that are easy to complete relative to others. Because objectives are not weighted against each other, communities could begin accumulating full points towards their score by completing the easiest objectives. Communities may also be more likely to join STAR if they know that they will receive credit for the measures they have already taken or that are easily within reach. Simply put, the simple weighting method makes the task of sustainability, and in this case the task of accumulating STAR points, appear more manageable. This weighting framework allows a community to define which objectives are the most important to them, so they can define their own path to sustainability given their capacity and resources. The objectives each community chooses could vary greatly depending on its region and scale and its economic, social, and political realities.

Weaknesses:

The major criticism of this model's weighting methodology is that it does not consider that some objectives have a greater impact on sustainability than others. Because the public's attitude towards a simple weighting framework is hard to predict, an overly simplistic model may actually reduce community buy-in to STAR because it lacks rigor in quantifying how a particular objective or point actually represents progress towards sustainability. Having equal weights for all objectives will push communities towards easy low cost objectives and avoid undertaking difficult high cost objectives. Since ease and cost have no direct correlation to impact, this strategy may be a poor indicator of a community's actual sustainability.

Figure 11. Summary of Simple Model Assessment

Strengths	Weaknesses
• Easy to understand and implement	• Simplicity easy to criticize/not rigorous enough
• Will promote cities to go after low hanging fruit	• Does not weight objectives based on relative impact to sustainability

Model B: Rubric-Based Weighting

Overview

Model B is presented as an example of a rubric-based weighting system of moderate mathematical complexity, similar to methodologies employed by LEED ND and AASHE STARS. To determine the importance of the objectives, Model B weights each objective individually, based upon a criteria-based rubric intended to be designed by the Design Task Force and filled out by TACs.

Methodology

To demonstrate what the rubric and weighting framework might look like, the model uses the three criteria in LEED: relative efficacy, duration of the benefit, and benefit of community control. To prepare this model, STAR experts would evaluate the objectives' impact by assigning each criterion an associative value from 1 -3, with 3 being the highest. The weight factor for an objective is obtained by multiplying the three values. The weight factor of a goal area is the sum of all its objective weight factors. To determine an objective's weight, its weight factor is divided by the goal area weight factor. For a community to calculate an objective score, the weight factor is multiplied by its completion value (0% - 100%). The final goal area score is the sum of its objective scores.

For example, in the Energy and Climate goal area in the Environment pillar, the objectives were randomly assigned associative values for each rubric criteria, which were multiplied to create the weight factor for each objective, as shown in Figure 12. Summing all the objective weight factors produces a total goal area weight factor of 78. For the Climate Adaptation objective, the rubric criteria values are 3 for relative efficacy, 3 for benefit duration, and 1 for benefit control. Therefore, the objective weight factor is the product of these three values, equaling 9 as shown below:

Relative Efficiency x Benefit Duration x Benefit Control = Objective Weight Factor

3 x 3 x 1 = 9

The weight factor 9 is divided by the goal area weight factor 78 to produce the objective's weight, equaling 12 percent as shown below.

$$\textit{Climate Adaptation Weight} = \frac{\textit{(Objective Weight Factor)}}{\textit{(Goal Area Weight Factor)}}$$

$$\textit{0.12 or 12\%} = \frac{9}{78}$$

In other words, the Climate Adaptation objective carries 12 percent of the total score for the Energy and Climate goal area. Using the same completion values that were randomly assigned in the illustration for Model A, an objective score can be determined by multiplying its weight factor by its completion value. In the illustration, the community achieved full completion for the Climate Adaptation objective, so it receives the full 12 percent towards the goal area score. The objective scores are summed to obtain the total goal area score; in this case it is 46 percent. Therefore, this community achieved 46% of the Energy and Climate goal area.

Figure 12. Rubric Model Example

Pillar	Environment							
Goal	Energy & Climate	Relative Efficacy (1-3)	Benefit Duration (1-3)	Benefit Control (1-3)	Weight Factor	Weight	Completed (1= Yes, 0 = No)	Score
Objectives	Greenhouse Gas Mitigation	3	2	2	12	15%	0	0%
	Climate Adaptation	3	3	1	9	12%	0	0%
	Resource Efficient Buildings	3	2	1	6	8%	1	8%
	Greening the Energy Supply - Nontransportation	3	1	1	3	4%	1	4%
	Greening the Energy Supply - Transportation	2	1	1	2	3%	0	0%
	Industrial Sector Energy Use	1	1	1	1	1%	1	0%
	Environmental Impacts of Agriculure & Aquaculture	3	3	3	27	35%	0	35%
	Energy Use - Infrastructure	3	3	2	18	23%	0	0%
Total					78	100%	3	46%

**Note: All values are rounded to the nearest whole number or percentage*

Assessment

A summary of the strengths and weakness of the rubric-based model is presented in Figure 13.

Strengths:

Model B incorporates a comprehensive rubric to inform the weighting of objectives, which would be determined by STAR experts. Experts can weight objectives to align more closely with STAR's mission for sustainability. It is ideal for a first iteration of STAR, which can be revaluated to incorporate more rigorous mathematical components after analysis of community performance. In addition, the rubric criteria can easily be adopted for objectives that defy quantitative assessment, such as those in the Society pillar. Cross-cutting objectives can also be weighted low to minimize double counting or magnification across goal areas.

Having weights clearly advises communities as to which objectives they can target as a priority to have the greatest impact on sustainability. Weighting using a rubric scale ensures that effort in the most important and difficult objectives are rewarded. Additionally, because the impact of objectives was measured through weighting, a community's final score would be a good indicator of its overall sustainability. Rubric based weighting of objectives is also expected to directly support decision-making and encourage communities to achieve the most important sustainability policies.

Weaknesses:

Because STAR's own TACs and Design Team experts will build the rubric criteria and use it to evaluate objectives, the model will be subject to criticism due to STAR's newcomer status in rating indices. Furthermore, since STAR is not yet an established brand, critics may question its authority to assign associative values to a rubric design of its own creation. While STAR's TACs and experts will use as much mathematical and quantitative rigor as possible, some subjectivity will inevitably be required to determine associative values and weight factors, especially for the more qualitative objectives. The subjective nature of determining associative values and weights could open up the model to further criticism that its assessment of sustainability is biased.

Figure 13. Summary of Rubric Model Assessment

Strengths	Weaknesses
• Weights objectives based on importance	• Rubric criteria design questionable
• Transparency and clarity	• Subjective weighting process

Model C: External Scorecard Model

Overview

This model uses a weighting framework that employs external scorecards to weight STAR objectives. The impact of each objective is assessed via the weighting of an external scorecard applied to each pillar. When an applicable scorecard was not available, they were subjectively weighted.

Methodology

In this model, we identified appropriate scorecards or weightings created by authoritative and credible organizations, and applied them to the Environment and Economy pillars of STAR. No appropriate scorecard was found for the Society pillar, so in the Education, Arts & Community and Affordability & Social Equity goal areas the objectives were weighted equally. In the Health & Safety goal area, the objectives were weighted based on the category of risk the objective addressed. In this way, the model can be described as comprehensive, utilizing a variety of different scorecards and weightings throughout the framework to identify the most sustainable practices. The basic method for applying an external scorecard to a pillar is to apply the weight value from a category within a scorecard to a relevant objective to produce its weight factor. If the objective is pertinent to more than one category from the scorecard, than a sum of the weights were applied.

For example, the Environmental pillar is weighted based on the EPA TRACI environmental impact category points. Leveraging the authority of the EPA, regulations and globally recognized standards, the metrics and indicators of each category are accepted and considered best practices by the United Nations Environment Program (UNEP)/Society of Environmental Toxicology and Chemistry (SETAC) Life Cycle Initiative (Bare, 2011). Objectives in the Environmental pillar were weighted based on their association with the following TRACI impact categories: Acidification, Eutrophication, Fossil Fuel Depletion, Global Warming, Habitat Alteration, Human Health, Ozone Depletion, and Water Intake, the weights of which are presented in Figure 14.

Figure 14. TRACI Impact Category Weights

Impact Category	Weight
Global Warming	16
Acidification	5
Eutrophication	5
Fossil Fuel Depletion	5
Indoor Air Quality	11
Habitat Alteration	16
Water Intake	3
Criteria Air Pollutants	6
Smog	6
Ecotoxicity	11
Ozone Depletion	5
Human Health	11
Sum	100

(National Institute of Standards & Technology)

An objective's weight factor is the sum of weights from the related impact categories. The weight factor of a goal area is the sum of all its objective weight factors. To determine an objective's weight, its weight factor is divided by the goal area weight factor. For a community to calculate an objective score, the weight factor is multiplied by its completion value (0%- 100%). The total goal area score is the sum of its objective scores.

For example, the objective Nature in the Natural Systems goal area relates to the Habitat Alteration and Water Intake TRACI impact categories, worth 16 and 3 points respectively. The objective weight factor is the sum of these points, equal to 19 as shown below and in Figure 15.

In other words the Nature objective contributes 11% to the Natural Systems goal area score. Using the same completion values randomly assigned in the other models, an objective's score can be determined by multiplying an objective's weight factor by its completion value. In the illustration, the community achieved full completion of the Nature objective, so it receives the full 11% towards the goal area score. The objective's scores are summed to obtain the total goal area score; in this case it is 69%. Therefore, the community achieved 69% of the Natural Systems goal area.

Objective: Nature — Relates to TRACI impact categories Habitat Alteration and Water Intake

Nature Weight Factor = Habitat Alteration TRACI Weight + Water Intake TRACI Weight
Nature Weight Factor = 16 + 3 =19

The weight factor 19 is divided by the goal area weight factor of 171.1, to produce the objective's weight, equal to 11%.

$$\frac{\textit{(Nature Objective Weight Factor)}}{\textit{(Natural Systems Goal Area Weight Factor)}} = \textit{Nature Weight}$$

$$\frac{19}{171.1} = 0.11 \text{ or } 11\%$$

Figure 15. External Scorecard Model Example - Environment

Pillar	Environment					
Goal	**Natural Systems**	**TRACI Category**	**Weight Factor**	**Weight**	**Completed (1= Yes, 0 = No)**	**Score**
Objectives	Nature	Habitat Alteration, Water Intake	19	11%	1	11%
	Waste Minimization	Habitat Alteration, Global Warming, Fossil Fuel Depletion	37	22%	1	22%
	Green Infrastructure	Habitat Alteration, Water Intake	19	11%	1	11%
	Water in the Natural Environment	Water Intake, Eutrophication	8	5%	0	0%
	Water Quality & Supply	Habitat Alteration, Eutrophication, Acidification	21	12%	0	0%
	Resource Lands	Habitat Alteration, Water Intake, Eutrophication	24	14%	0	0%
	Biodiversity & Invasive Species	Habitat Alteration	16	9%	1	9%
	Ambient Noise & Light	Habitat Alteration, Human Health	27	16%	1	16%
Total			**171.0**	**100%**	**5**	**46%**

**Note: All values are rounded to the nearest whole number or percentage*

The Economy pillar is weighted based on the 2004 Genuine Progress Indicator (GPI) index which quantifies the benefits and ills of society in dollars. GPI integrates economic, social, and environmental factors into a composite measure so that the benefits of economic activity can be weighed against the costs. The Economy pillar bases the weighting of its objectives on the following select GPI category expenditures: Cost of Crime, Cost of Underemployment, Net Capital Investment, Services of Highways, Value of Higher Education, and Value of Leisure. Their values are presented in Figure 16.

Figure 16. GPI Category Expendi-

GPI Categories	2004 Expenditures
Cost of Crime	34.22
Cost of Underemployment	176.96
Net Capital Investment	388.8
Services of Highways	111.55
Value of Higher Education	827.98
Value of Leisure	401.92

(John, Clifford, & Noah,

For the exercise, we subjectively applied GPI categories to objectives. An objective's weight factor is the sum of values from the related categories. The weight factor of a goal area is the sum of all its objective weight factors. To determine an objective's weight, its weight factor is divided by the goal area weight factor. For a community to calculate an objective score, the weight factor is multiplied by its completion value. The total goal area score is the sum of its objective scores.

For example, the objective Economic Localization objective in the Economic Prosperity goal area subjectively relates to Net Capital Investment and Cost of Crime, worth 388.80 and 34.22 respectively. The objective weight factor is the sum of these values, which equals 423 as shown below and in Figure 16.

Objective: Economic Localization — Relates to GPI categories Net Capital Investment and Cost of Crime

Net Capital Investment GPI Weight + Cost of Crime GPI Weight = Economic Localization Weight Factor

$$388.80 + 34.22 = 423$$

The objective weight factor 432 is divided by the goal weight factor of 2401.2, to produce the objective's weight, equal to 18%. In other words the Economic Localization objective contributes 18% to the Economic Prosperity goal area score.

$$\frac{\textit{(Economic Localization Objective Weight Factor)}}{\textit{(Economic Prosperity Goal Area Weight Factor)}} = \textit{Economic Localization Weight}$$

$$\frac{423}{2401.2} = 0.18 \text{ or } 18\%$$

Using randomly assigned completion values, an objective's score can be determined by multiplying its weight factor by its completion value. In the illustration, the community achieved full completion of the Economic Localization objective, so it receives the full 18% towards the goal area score. The objectives scores are summed to obtain the goal area total score; in this case it is 49%. Therefore, the community achieved 49% of the Economic Prosperity goal area.

Figure 17. External Scorecard Model Example - Economy

Pillar	**Economy**					
Goal	**Economic Prosperity**	**GPI Category**	**Weight Factor**	**Weight**	**Completed (1= Yes, 0 = No)**	**Score**
Objectives	Enterprise Support	Net Capital Investment	389	16%	1	16%
	Market Development	Net Capital Investment	389	16%	1	16%
	Green Infrastructure	Net Capital Investment	389	16%	1	16%
	Water in the Natural Environment	Net Capital Investment	389	16%	0	0%
	Water Quality & Supply	Net Capital Investment, Costs of Crime	423	18%	0	0%
	Resource Lands	Net Capital Investment, Costs of Crime	423	18%	0	0%
Total			**2401**		**3**	**49%**

**Note: All values are rounded to the nearest whole number or percentage*

We could not find a suitable scorecard to apply to the Society pillar (further research to identify an applicable external scorecard is needed in the future). Therefore, we weighted the objectives equal to each other within the Education, Arts & Community and the Affordability & Social Equity goal areas. In the Health & Safety goal area we created a three tiered weighting scale based on the level of risk the objective aimed to address. Life-saving objectives were given a high score of 3, illness prevention a moderate score of 2, and wellness promotion a low score of 1, presented in Figure 18.

Figure 18. Risk Level Weights

Risk Level	Weight
High (Life Saving)	3
Moderate (Illness Prevention)	2
Low (Wellness Promotion)	1

The weight factor of a goal area is the sum of all its objective weight factors. To determine an objective's weight, its weight factor is divided by the goal weight factor. For a community to calculate an objective's score, the weight factor is multiplied by its completion value. The total goal area score is the sum of its objective scores.

For example, the Safe Communities objective is categorized as life-saving so it receives a weight factor of 3. The weight factor 3 is divided by the total weight factor 22 to produce the objective's weight, which equals 14%, as shown in Figure 19. In other words the Safe Communities objective contributes 14% to the Health & Safety goal area score. Using randomly assigned completion, an objective score can be determined by multiplying an objective's weighting factor by its completion value. In the illustration, the community achieved full completion for the Safe Communities objective, so it receives the full 14% towards the goal area score. The objective scores are summed to obtain the total goal area score; in this case it is 55%. Therefore, the community achieved 55% of the Health & Safety goal area.

Figure 19. External Scorecard Model Example - Society

Pillar	**Society**					
Goal	**Health & Safety**	**Risk Level**	**Weight Factor**	**Weight**	**Completed (1= Yes, 0 = No)**	**Score**
Objectives	Health System	High (Life Saving)	3	14%	0	0%
	Safe Communities	High (Life Saving)	3	14%	1	14%
	Emergency Prevention & Response	High (Life Saving)	3	14%	1	14%
	Natural & Human Hazards	High (Life Saving)	3	14%	1	14%
	Outdoor Air Quality	Low (Wellness Promotion)	1	5%	1	5%
	Health & Safety Literacy	Moderate (Illness Prevention)	2	9%	0	0%
	Toxics Reduction	High (Life Saving)	3	14%	0	0%
	Workplace Health & Safety	Moderate (Illness Prevention)	2	9%	0	0%
	Food Access & Nutrition	Low (Wellness Promotion)	1	5%	1	5%
	Active Living	Low (Wellness Promotion)	1	5%	1	5%
Total			**22**	**100%**	**6**	**55%**

**Note: All values are rounded to the nearest whole number or percentage*

Assessment

A summary of the strengths and weaknesses of the external scorecard model is presented in Figure 20.

Strengths:

Utilizing external scorecards for weighting is less subjective than other methods. Additionally by utilizing TRACI and GPI indices, objective weightings are established by credible institutions that have undergone rigorous evaluation processes. The model can potentially utilize scorecards that accurately and impartially assess sustainability, adding a level of scientific rigor to the model.

Weaknesses:

While the weightings from the external scorecards are credible, they were designed for the purposes of the organizations that created them. While they can be applied to STAR, they are not perfect fit to the objectives. To apply external scorecards, STAR may need to re-organize objectives into other goal areas or pillars. In addition, the scorecards do not provide a single rubric across all kinds of objectives. Thus, they cannot accommodate the categorization schema STAR currently uses, which groups some quantitative scientific objectives, Energy Use for instance, with qualitative policy objectives, such as Education.

Another weakness of Model C is that it does not measure the association between the objective and outcome. For example, it does not measure the impact of an objective on the impact category from EPA TRACI or the expenditure category from GPI. Therefore, despite the fact that an objective might have a mild impact, the objective is given weight for impacts it would not otherwise be assigned if its association to a desired outcome is not determined.

Figure 20. Summary of Scorecard Model Assessment

Strengths	Weaknesses
• Comprehensive and rigorous weighting process	• External scorecards do not perfectly fit STAR objectives
• Use of external scorecards from established and credible institutions	• Does not measure association between objectives and outcomes

Recommendations and Justifications

Design Assumptions

Through our analysis of the six case studies and the development of the three models, we have reached a series of recommendations for the STAR Community Index point allocation system, weighting system as well as general recommendations for STAR Communities.

Point Allocation Structure

Percentage (100-point) Scoring:

We recommend that STAR use a 100-point system as this will make STAR easily understandable and accessible. It is an intuitive way for users to know how sustainable a community is within the STAR framework. A score of 100 points represents 100% completion of all STAR objectives.

Rating Thresholds:

STAR Communities should receive a rating based on achieving a certain number of points (e.g. 1-5 stars). The lowest level rating can be awarded to all participating communities, as in AASHE STARS, or to ones that reach an established baseline, as in LEED. The highest level rating can either be at the top of the 100-point scale, in which a community would need to achieve a perfect or near perfect score. This gives cities a far-reaching goal to strive for but also may be discouraging if it is impossible to achieve. The best performing community could be used as a reference to determine what is practically achievable. For example, if the best performing community scores around a 60, this range could be considered the threshold for the highest rating. In this way, top cities receive the highest honor. Data from the Beta Communities may help determine where the thresholds should be. However, communities are expected to improve their scores over time, so the thresholds may have to be adjusted every few years. For example, while 60 may be today's highest rating, it could possibly be in the range of low performing communities in years from now.

Weighting System

Equal Weighting across Pillars:

We recommend that pillars be weighted equally to ensure STAR's core value of an interconnected, triple bottom-line approach to sustainability. This would be achieved by averaging the scores from the goal areas so that each pillar is worth one third of a total possible score. Weighting the pillars equally underscores the importance of this multi-faceted approach. Averaging also allows for the potential addition or subtraction of goal areas from the STAR framework.

Equal Weighting across Goal Areas:

All goal areas should be weighted equally within pillars and averaged to produce the pillar score. This is based on three reasons. Firstly, the goal areas serve as the foundation of the pillars and uneven weighting at this level would affect our primary recommendation. Secondly, there are currently no universally accepted metrics for rating one goal area of greater importance or value than any other and doing so would generate criticism of STAR. Thirdly, averaging allows for greater flexibility to add or remove objectives.

Different Weighting across Objectives:

We recommend that objectives within goal areas be weighed against each other through the use of a STAR defined rubric. Although objective weighting is more complicated then equal weighting, utilizing this begins to incorporates the impacts that different objectives have on sustainability within the STAR Index. The sum of weighted objectives within a goal area would equal the total goal area score.

Expert-Defined Weighting for Objectives:

We recommend that the TACs weight objectives based on a STAR-designed rubric. In some rating systems, experts use a single associative factor as a multiplier. We believe that the multiplier should be more complex with several associative factors to create a more comprehensive weighting system.

The rubric criteria should best exemplify the ways that objectives meet STAR's mission of sustainability. LEED uses just three rubric criteria: efficacy, duration, and control. However, the central mission of LEED, to promote sustainable building practices, is more narrow and focused than that of STAR, which encourages sustainability from a holistic viewpoint. Accordingly, STAR may want to use a rubric more similar to that of AASHE STARS which differentiates to what extent the credit contributes individually to improved environmental, financial, and social impacts, and also addresses the breadth and depth of impact. These results combine to create a weight factor for each credit. Following this methodology, ranking objectives on a scale from 1-10 based on their contribution to environmental, economic, and societal benefits in terms of breadth and depth, would provide a comprehensive weighting system for STAR. An example of this is shown in Figure 21 using randomly assigned values.

	Breadth		Depth		Total
Environment	8	x	7	=	56
Economy	6	x	4	=	24
Society	7	x	5	=	35
			Weight Factor		**115**

TAC's would consider and determine for each objective within their goal area the outcomes of objectives on each of the three pillars. In addition, it could be used to prioritize objectives that have synergistic impacts. In order for the system to assess the breadth and depth of objectives, We recommend that TACs set levels for the number of people/ percent of the community impacted and the degree of impact. Upon completing the process of streamlining the objectives and designing the rubric, STAR should begin the weighting process. A survey tool would be sent to the experts remotely to expedite the process and ask the following questions:

- **Environment:** What is the objective's impact on the environment?
  - o **Breadth:** How many people/ percent of the community is impacted by this objective?
  - o **Depth**: How deeply does this objective impact people?

Breadth x Depth = Environment Impact

- **Economy:** What is the objective's impact on the economy?
    - o **Breadth:** How many people/ percent of the community is impacted by this objective?
    - o **Depth:** How deeply does this objective impact people?

Breadth x Depth = Economy Impact

- **Society**: What is the objective's impact on society?
    - o **Breadth**: How many people/ percent of the community is impacted by this objective?
    - o **Depth**: How deeply does this objective impact people?

Breadth x Depth = Economy Impact

Environment Impact x Economy Impact x Society Impact = Objective Weight Factor

Partial Credit for Objectives:

We recommend a partial credit structure with a maximum of 10 thresholds, in which a community could obtain a percentage of the points available for a credit. This more accurately represents a communities progress for completing an objective and encourages communities to begin objectives even if they are not able to achieve full credit. STAR objectives are ambitious, so it will be difficult for many communities to fully complete them. Sustainability is a process and the performance measures within each objective provide the opportunity to assign partial credit. Although credit could be awarded with a full scalar input, this arrangement would result in obscure decimal point values when aggregating data, adding complexity and possible confusion. Thus, TACs should develop thresholds for partial credit for each objective, based upon the desired outcome and available local government actions.

General Recommendations

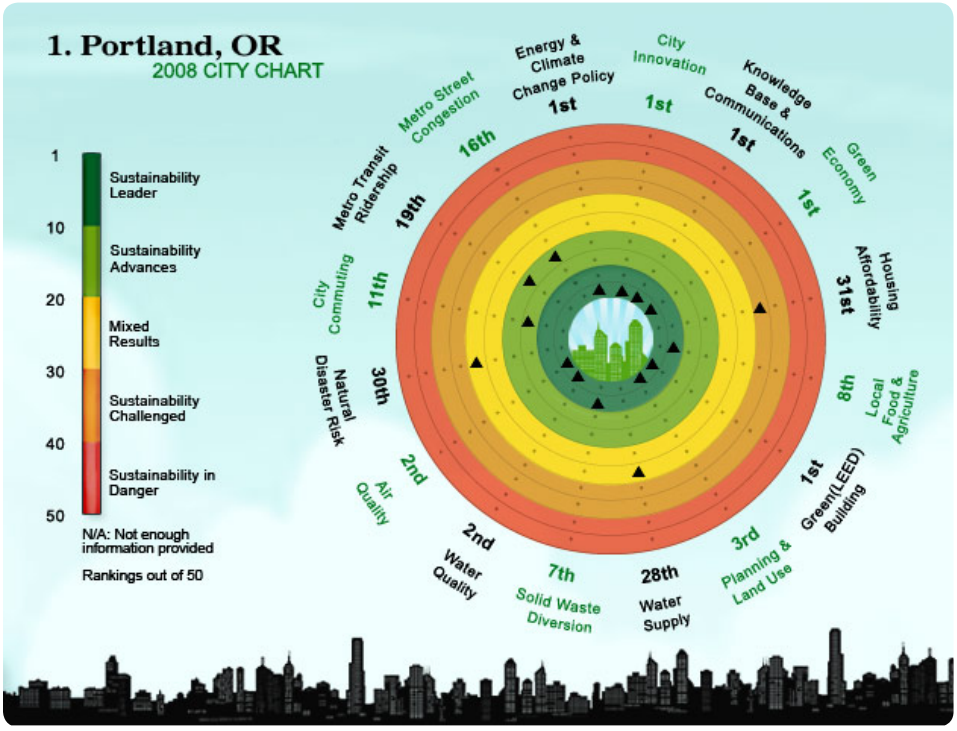
The above suggestions provide a clear pathway for STAR to proceed in developing its first point allocation system. Next, we explored a variety of innovative options that could be incorporated into STAR, as sophistication and number of communities using the system grow.

Operating Platform:

A simplistic, user-friendly online platform for the aggregation of community data and community networking is essential. Ideas for presenting the data include:

- Displaying the three pillars as a composite of the overall score in a pie chart.
- Highlighting which communities are doing best per pillar, goal area, and objective.
- Grouping communities with similar features (size, climate, GDP, etc.) together to understand why some perform better than others.
- Showing how a community's score changes over time using graphs, which communities' scores are advancing the most, etc.
- Utilizing an attractive visual representation of a community's score to educate and engage people. Figure 22 presents an example from SustainLane, another sustainability rating system.
- Incorporate geo-spacial tools so that communities can cross analyze their own progress.

Figure 22. SustainLane Portland City Chart



(SustainableCircles Corp., 2010)

Simplify the Number of Objectives:

We recommend streamlining and reducing the total number of objectives. Condensing overlapping objectives or broadening an objectives scope to incorporate multiple community level outcomes to achieve credit would make the STAR framework less overwhelming. Thereby reducing barriers to entry and allowing communities to easily engage in the STAR rating process.

Require Prerequisites:

In order to protect the STAR brand as the baseline for tracking community progress towards sustainability, we believe that some degree of prerequisite should be required. Bearing this in mind, prerequisites should not impose an additional barrier to entry; they should be markers that all communities should be reasonably able to achieve.

We recommend that prerequisites exist outside of the community level outcomes. For example, every STAR community should begin an objective within each pillar, or goal area. This would counter criticism that a community could ignore entire pillars or goals; thereby reinforcing STAR's value for an integrated approach to sustainability. An alternate option for prerequisites that are associated with objectives could be to use measures that are already required of communities at all levels, i.e. high school graduation rates.

Community Boundary Survey:

Communities that join STAR should complete a community boundaries survey. This simple information gathering exercise would help to identify individual community's size, scale, infrastructural and regional differences. These markers can be used by communities to accurately compare themselves amongst their counterparts. It could also be used internally within the STAR Community Index to include or exclude region-specific objectives or regional multipliers.

Regional Variation:

In order for STAR to define a general standard for sustainability, it will need to incorporate the inherent

differences that exist between communities due to climate, ecosystem, and geographical variation. We have identified several ways to incorporate regionality into the STAR framework. First, a suite of regional objectives would need to be identified and developed; they would reside in either, the Innovation and Process goal or as objectives within relevant goal areas. To be incorporated into the STAR system the objectives could be achieved as additional points (extra credit) for applicable communities, or removed from a community's objective list as per the results of a community boundary survey. A second option is to incorporate the use of regional multipliers that could either be developed by the TAC's and STAR experts or taken from external sources such as TRACI or other credible systems.

Cross Goal Weighting:

STAR should consider using a weighting process to compare all objectives against each other, across all pillars and goals, to fully account for the impact of each objective to the overall framework. However, we believe this process is currently too complex, cumbersome and susceptible to criticism for version 1.0 of the STAR Community Index.

Conclusion

STAR Communities integrates environmental, economic and societal strategies in order to align local priorities with sustainable practices. STAR's performance measurement system addresses multiple goals by helping communities to focus on sustainability initiatives with measurable outcomes. Over time, communities will be able to track their own sustainability, making STAR a rating system for progress as opposed to a static ranking system. Utilizing robust community level data and geospatial analysis, STAR will facilitate decision-making at all levels. Through a standardized framework communities will have the opportunity to compare themselves to each other, as well as learn from and share best practices to becoming more sustainable.

This report details the decision making process for a rating system that is easy to implement, comprehensive in scope and attractive to communities of any size and character. The recommendations for a 100-point score and equal weighting across pillars and goal areas emphasize STAR's core values to provide a system that is both easily accessible and equitably integrates sustainability into all aspects of community life. Weighting objectives differently within goal areas emphasizes the relative impacts of different objectives for sustainability. This methodology facilitates a rigorous measure of progress. Utilizing STAR's network of experts to identify and establish rubric-based weighting for objectives increases the likelihood of accurate measurement and broad acceptance of the system. In addition to the proposed point allocation and weighting schema, this report has presented a range of issue-specific analysis to be considered as this program is rolled out. Our recommendations were created to assist STAR as they begin to influence sustainability practice and policy, and become the national standard for community sustainability.

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Appendix

A. STAR Framework

Environment	Economy	Society
Natural Systems	**Economic Prosperity**	**Education, Arts, & Community**
Nature	Enterprise Support	Education
Waste Minimization	Market Development	Civic Literacy & Engagement
Green Infrastructure	Land Redevelopment & Revitalization	Community Cohesion
Water in the Natural Environment	Neighborhood & Community-Based Economic Development	Social & Cultural Diversity
Water Quality & Supply	Economic Localization	Arts, Culture, & Civic Support
Resource Lands	Industrial Sector Development & Revitalization	Financial Literacy
Ambient Noise & Light		Ecological Literacy
Biodiversity & Invasive Species		
Planning & Design	**Employment & Workforce Training**	**Health & Safety**
Comprehensive Planning	Workforce Development	Health System
Public Participation in the Planning Process	Equal Employment Opportunity	Safe Communities
Codes, Ordinances, & Requirements	Living Wages & Benefits	Emergency Prevention & Response
Compact & Complete Communities	Labor Rights	Natural & Human Hazards
Transportation & Mobility	Workplace Learning & Career Paths	Outdoor Air Quality
Housing	Supportive Workplaces	Health & Safety Literacy
Public Spaces		Toxics Reduction
Historic Preservation		Workplace Health & Safety
Land Conservation		Food Access & Nutrition
		Active Living
Energy & Climate	**Innovation & Process**	**Affordability & Social Equity**
Greenhouse Gas Mitigation	Regional Priority Issues	Equity Assessment & Planning
Climate Adaptation	Exemplary Performance	Government Transparency
Resource Efficient Buildings	Innovation	Civil & Human Rights
Greening the Energy Supply - Nontransportation	Community Engagement in STAR	Adjudication & Restorative Justice
Greening the Energy Supply - Transportation		Equity Literacy
Energy Use - Infrastructure		Community Empowerment
Industrial Sector Energy Use		Environmental Justice
Environmental Impacts of Agriculture & Aquaculture		Revenue Generation
		Public Expenditures & Financial Investment
		Poverty Prevention & Alleviation
		Human Services

(ICLEI - Local Governments for Sustainability USA, 2012)

B. Acronyms

Term	Definition
AASHE	Association for the Advancement of Sustainability in Higher Education
BEES	Building for Environmental and Economic Sustainability
CLO	Community Level Outcome
EPA	Environmental Protection Agency
EPI	Environmental Performance Index
ESI	Environmental Sustainability Index
GLA	Government Level Action
ICLEI	Local Governments for Sustainability
IEF	Index of Economic Freedom
LEED ND	Leadership in Energy and Environmental Design for Neigborhood Development
NIST	National Institute of Standards and Technology
STAR	Sustainability Tools for Assessment and Rating
STARS	Sustainability Tracking, Assessment & Rating System

C. Training and Education Curriculum

Introduction

The programs proposed below are designed to familiarize prospective users of local governments with the STAR Community Index and the related online tools. Due to the varying nature and goals of training for different audience groups, separate programs have been devised for a small-group (single local government) training session and a large-group seminar with participation from multiple local governments. The aim of a small-group, single community session is not only to provide the fundamental training on the rating system, but also to customize the training to suit the respective community's interests and concerns. The main objective of a large-group seminar is to inform a diverse group of participants from communities with varying interests and concerns on sustainability issues, and in doing so, also promote STAR as a necessary tool in enhancing regional sustainability.

Training in a small-group setting

1. Assumptions

A. An audience of a small group of representatives (< 20) of a single local government

B. A 4-hour meeting at a venue arranged by the respective local government

C. One representative from STAR traveling to the respective location for the training session, with the travel expenses of STAR representative and other costs associated with the meeting covered by the respective local government

D. Basic information on the sustainability efforts and progress of the respective local government and community has been provided to STAR in advance of the training session to allow for a customized curriculum

E. Point allocation is complete, online platform and help tools have been launched and are readily available to STAR users

2. Program

Time (min.)	Program
30”	• Introduction of speaker/participants • Overview of STAR Community Index - Objectives and necessity of STAR - Background on the inception of STAR and the guiding principles - Governance structure of STAR and the roles of each committee - Introduction to the framework of the rating system
80”	Framework and Performance Measures of STAR • Overview of the 3 pillars • Description of the goal areas and points available • For the objectives of interest for the respective community, description of: - Metrics/indicators - Weights (if any) - Performance measures (CLOs, LGAs)
20”	Demonstration of STAR online resources & tools
20”	Break
90”	Consultation • Assessment of community or local-government specific issues and concerns • Examples of best practices from communities that share similar situations • Consultation on strategies to be pursued for STAR certification

Training in a large-group setting

1. Assumptions

A. An audience of 50 or more representatives from various local governments (prospective and current users of STAR)

B. Seminar-style arrangements preferably in a prominent location

C. Speakers for each session can vary and are to be determined based on field of expertise and availability

D. May require registration fees from participants to cover the costs of catering and rental (to be determined based on budget availability)

E. Point allocation is complete, online platform and help tools have been launched and are readily available to STAR users

2. Program

Time	Program	Remarks
08:30 - 09:00	Registration	- Light refreshments - Handouts, name tags
09:00 - 09:05	Opening Speach	
09:05 - 09:20	Overview of STAR Community Index	
09:20 - 10:15	Framework and Performance Measures of STAR I	- Environment Pillar - Includes Q&A
10:15 - 10:30	Coffee Break	Light refreshments
10:30 - 12:00	Framework and Performance Measures of STAR II	- Economic & Society Pillars - Includes Q&A
12:00 - 12:30	Introduction to STAR online resources & tools (if any)	Interactive
12:30 - 13:30	Lunch	On-site, catering
13:30 - 14:00	Best Practices in Local Government Sustainability Management and the Way Forward	- Includes Q&A
14:00 - 15:00	1:1 Consultation with STAR Experts	Pre-arranged 20-min meetings
15:00 - 15:10	Closing	

3. Detailed Contents of Each Session

A. Overview of STAR Community Index

- Definition and objectives of STAR Community Index
- Background on the inception of STAR and the guiding principles
- Governance structure of STAR and the roles of each committee
- Introduction to the framework of the point system

B. Framework and Performance Measures of STAR I, II

- Overview of the respective pillar(s)
- Description of the goal areas and points available
- For each objective:
    - Metrics/indicators
    - Weights (if any)
    - Performance measures (CLOs, LGAs)

C. Introduction to STAR Online Resources & Tools

- Overview of the information and functions available/accessible online
- Demonstration of using online resources & tools
- Interactive session with participants

D. Best Practices in Local Government Sustainability Management and the Way Forward

- Case study of a STAR Beta Community or another highly-sustainable city/county (national or international)
- Initiatives taken by the local government, rationale, and time frame
- Budget and/or expenditures for sustainability initiatives
- Specific outcomes
- Applicability to STAR and/or STAR certification/rating
- Challenges and/or limitations
- Ways forward

E. 1:1 Consultation with STAR Experts

- Pre-arranged meetings between participants and STAR experts (interested participants must apply when registering for the event)
- 20-minute time slots for each consulting session to provide customized consultation for local governments with varying circumstances and issues at hand
- Could be used to encourage more local governments to participate in STAR

Presenter Notes

Defining the STAR Community Index

Slide Objectives

- To establish a clear definition of the STAR Community Index
- To examine the distinctive features that make STAR more than a rating system

The STAR Community Index is the first comprehensive sustainability rating system developed specifically for local governments.

It is distinguished from other existing rating systems in that it is more than just a rating system; STAR is a framework and a tool that enables local governments to plan, gauge, and manage the sustainability of their communities. The distinguishing characteristics of STAR are as follows:

1. STAR is a rating system and an online platform designed specifically for local governments, such as counties and cities, to continuously strive for greater community health and prosperity. Through a national standard and rating system, STAR provides communities of any size a roadmap for improving their sustainability.

2. It also offers its users online tools for strategic planning and performance management in sustainability. Its online platform offers users tools for project management, document sharing, data gathering and performance reporting, and customer management. It also features an online commons where users can share best practices as well as assess their accomplishments relative to other communities, and a dashboard that is integrated with the user website.

3. STAR also uses specific and standardized metrics to quantify sustainability goals that are often qualitative in nature.

STAR is also characterized by a unique framework that enables users to gauge progress across the intertwining environmental, economic and social dimensions of a community's sustainability. Communities participating in STAR are assessed not only for their environmental health, but also their standing in economic and social equity goals, often overlooked in green initiatives.

Example: Economic Localization

The purpose of including this category within STAR is to strengthen and diversify local economies and increase community wealth by developing localized networks for economic exchange and increasing the total number and market share of locally owned businesses.

This category is measured using metrics based on figures from widely recognized sources including the Bureau of Labor Statistics and the American Community Survey by the U.S. Census Bureau, formulated into a scoring system by a group of field experts consisting of the respective technical advisory committee.

The STAR Community Index Framework

Slide Objectives

- To present a big picture view of the entire STAR framework
- To cover the terminology associated with the framework and examine the components of each layer of the framework

STAR incorporates the widely recognized concept of the three pillars of sustainability into its framework as the priority areas for local governments in pursuing greater sustainability. Communities are required to strive for a balanced improvement in all three areas in order to score higher within the STAR framework.

Origin of the Three Pillars of Sustainability

The need for examining different dimensions of sustainability was highlighted in the World Commission on Environment and Development (WCED) report "Our Common Future" of 1987, a historical milestone document in defining and setting the guiding principles for sustainable development which eventually came to be known commonly as the Brundtland Report. The report, in defining sustainable development, identified three fundamental building blocks of the concept: environmental protection, economic growth and social equity. The underlying assumption of stipulating these three components as necessities for sustainable development is that "A world in which poverty and inequity are endemic will always be prone to ecological and other crises." (World Commission on Environment and Development. Our Common Future. Oxford: Oxford University Press, 1987).

This idea of sustainability consisting of three components was further reinforced at the United Nations 2005 World Summit, which called for a need to integrate them into "interdependent and mutually reinforcing pillars." (United Nations. "2005 World Summit Outcome." 2005. 25 March 2012. <http://daccess-ods.un.org/TMP/3224135.html>.

Under each pillar are three goal areas that a local government can achieve, and therefore a total of nine goal areas in the entire framework.

Under each goal area are several objectives, or the specific outcomes that local governments must achieve in order to move toward achieving the goals. In order to achieve credit for each objective, communities must complete requirements related to community level outcomes (CLOs) and/or local government actions (LGAs). CLOs are the preferred state or condition in terms of community sustainability. Local government actions (LGAs) are preparatory steps or implementation measures that are proven effective and essential toward achieving the desired outcome and therefore encouraged for local governments to take. With most objectives, CLOs result in a larger credit than LGAs since they represent real changes in communities.

Environment > Natural Systems > Waste Minimization

OBJECTIVE: Waste Minimization

Credit Earned **Performance Measures**

100% *Community Level Outcomes*

1. Meet or exceed an incremental straight-line annual reduction, relative to a common long-term target of a 100% reduction in total solid waste generated within the jurisdiction that is disposed of via landfill or incinerator by 2050 (100x50) from a baseline year not predating 1995.
2. Meet or exceed an incremental straight-line annual reduction, relative to a common long- term target of a 100% reduction in local government generated solid and hazardous waste that is disposed of via landfill or incinerator by 2040.

70% *Local Government Action*

1. Creation of waste minimization plan	10. Electronic waste programs
2. Establishment of formal waste reduction goals and policies	11. Commercial waste programs
3. Education and promotion	12. Reuse - support and cooperation with non-profits, etc.
4. Recyling programs: drop-off, curbside recycling, volume-based/ pay-as-you-throw	13. Materials exchanges/by-product synergy (waste from one industry used by another)
5. Organics management program	14. Specialized wastes program
6. Household hazardous waste program	15. Multi-family recycling access program
7. Waste to energy conversions	16. Product bans or recycling requirements
8. Targeted recycling: schools, events, airports, parks, etc.	17. Development of regional partnerships in order to enhance ability to address waste management needs
9. Construction and demolition management programs	

Key Terms

Pillars – The three building blocks of sustainability: Environment, Economy, and Society

Goal – Comprehensive community-level aspirations toward achieving sustainability and categorized under one of the three pillars

Objective – A clear, desired outcome intended to move the community toward the goal

Performance Measures – Community Level Outcomes and Local Government Actions that represent progress toward completing an objective

Community Level Outcome – Actual state of a system that can be compared to a desired state to identify progress toward completing an objective

Local Government Action – Preparatory implementation steps proven effective and essential to achieving

Image Sources

Title page: Green City. February, 2012. http://184.107.134.62/green-city-wallpaper.1024x768.download.html

Page 5: Green Roof. April 2012. http://www.flickr.com/photos/arlingtonva/4898122903/sizes/o/in/photostream/

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