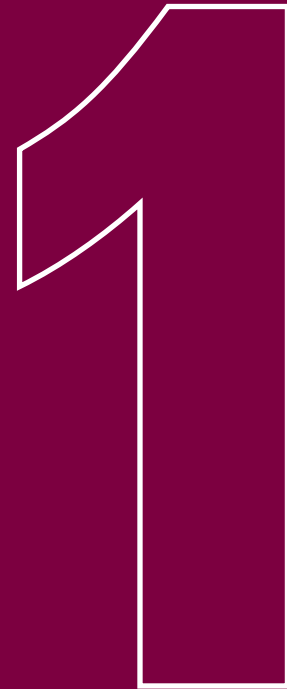




# section



APPENDIX

The New Sustainable Frontier

PRINCIPLES OF SUSTAINABLE DEVELOPMENT

September 2009



# operating sustainably

Case Studies

Tools and Strategies

Interviews



NATIONAL EXECUTIVE POSITIONS by February 7		
	Actual	Target
CABLE	62%	63%
COMMERCE	63%	63%
HEALTHCARE	61%	63%
TECH	58%	No Target

# case studies

Buildings

Organizations

# introduction

Since the original “GSA Real Property Sustainable Development Guide” was published in 2000, we have seen education and awareness increase public understanding and add a sense of urgency to the idea that sustainability is not just a better way to do business, but an absolute necessity. And while new product and building rating systems are helping to transform the way we live and work, we remain far from achieving a steady state of sustainability.

Operating sustainably will require reexamination of our everyday practices and tools with our closed-world limitations in mind.

In this section, we begin to consider case studies and tools in the context of the principles of sustainability:

1. Sustainable Scale – defined by the Earth’s finite limits, in which efficient allocation and just distribution must be maintained, if a stable, steady-state economy is to be attained,
2. Just Distribution – that allocates the Earth’s finite resources so that all can live with respect, and,
3. Efficient Allocation – the basis of traditional economics, which maximizes the utility of resources through a properly functioning marketplace.

While we were unable to identify examples that systematically apply all of these principles, we hope those that follow will help to illustrate ways these ideas can be applied to a more comprehensive approach. Future case studies should deliver the closed-world system we envision.

“Achieving sustainable government operations and a sustainable world, depends on eliminating our adverse impacts on the environment – getting to “net zero” - by reducing natural resource and energy use, eliminating toxics and greenhouse gas emissions, and restoring public goods such as ecosystem services. It also depends on achieving environmental goals in a manner that supports the Government’s social goals.

Once we understand the principles of sustainability, we can begin to incorporate them into our daily practices. This does not mean that we must have a complete knowledge of every aspect of every product or service we use, but it does require that we understand the principles of sustainable development, articulate our goals clearly, and ask the right questions of those who should know every aspect of every product or service: the producers and providers.”

*“The New Sustainable Frontier:  
Principles of Sustainable Development” (September 2009)*

# buildings



# 700 sixth street

700 Sixth Street is an office building in a dense, mixed-use neighborhood with easy access to amenities: shops, restaurants, housing, major bus routes and a Metro Station.

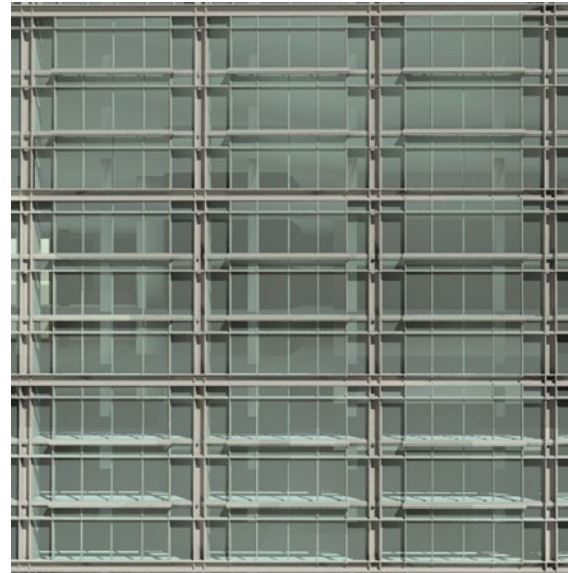
By locating this 12 storey office building downtown, Akridge was able to provide future occupants an abundance of commuting and housing choices potentially helping tenants retain staff, and minimize carbon emissions by promoting sustainable modes of transportation. Bike racks and a gym with showers were included, as well as ten percent of parking reserved for alternative fuels and car sharing vehicles.

The 700 Sixth Street site was originally a brownfield, with underground gasoline tanks, which required removal and remediation of 8,700 tons of contaminated soil. Commercial development on brownfield sites and within urban centers minimizes use of greenfields and natural resources, and maximizes use of existing infrastructure, reinforcing the maintenance and improvement of existing development. Additionally, its location is more convenient for visitors and contributes to the support of nearby businesses.

At approximately 13,000 sq. feet, 700 Sixth Street's green roof is the largest green roof on a privately developed building in Washington, DC. The green roof will capture, filter, and re-use rain water for landscaping, diverting it from the municipal sewage system. Washington, DC, like many older cities, has a combined sewage and storm water system. During storm events, the system is often overwhelmed and sewage is released into the local waterways causing environmental damage and creating a public health hazard. Use of the green roof reduced the amount of impervious surface area previously on the site, thereby reducing the burden on infrastructure.

The green roof also mitigates the heat island effect - an increase in temperature due to the concentration of surfaces that absorb the heat from the sun. In some cases, temperatures can be 15 degrees hotter than the surrounding areas. An added benefit is the outdoor deck, which provides for the enjoyment of building occupants adjacent to the green roof area.

Thermal performances of the building envelope, specification of efficient light fixtures, and the use of occupancy sensors and timers for lighting controls, contribute to a 17.5% reduction in energy use below the ASHRAE/IESNA standard 90.1-2004. Low flow plumbing fixtures, waterless urinals, and automatic controls reduce water usage by 40%. This project is currently targeting a LEED CS v2 Platinum rating.



## Architect/Designer

HOK Architects

## Owner

The John Akridge Company

## Developer

The John Akridge Company

## Completed

Spring 2009

## Project Area

300,000 sq. ft.



# birmingham social security center

The Birmingham Social Security Center is a nine-storey commercial building anchoring the edge of Birmingham's Civil Rights District.

The Social Security Administration (SSA) redeveloped an existing Brownfield lumber yard using a multi-criteria assessment process to guide the building's design toward achieving LEED Silver certification. As a result, the project team realized fundamental elements such as open work areas, refurbished work stations, daylighting, and a highly efficient mechanical system were essential to a sustainable space.

High ceilings allow for ease of flexibility in re-configuring the interior layout and the design meets its target of a 30% reduction in energy use from the baseline model. The mechanical system includes an energy recovery entropy wheel with under-floor delivery and controls for approximately every 2.5 people. The exterior horizontal shades on the south facing elevations of the building reduce the cooling load without diminishing the daylight and views. The lighting fixtures use daylight responsive lighting controls to maximize the energy savings. The client's requirement for blast windows also benefits the staff because of additional acoustical insulation from the outside and it is a better filter of UV light than standard glazing.

The final product enhances collaboration amongst staff by integrating different types of meeting spaces. Dubbed, the "Main Street," a double height concourse traverses the site from which the staff can access the cafeteria, bank, shops, business center, etc. At each floor there is a staggered floor plate area adjacent to the elevator core to provide double height shared amenity spaces called "Neighborhood Centers" or "Family Rooms".

Low flow fixtures and automatic controls reduce potable water-use by 50%. Fabric canopies at the top deck of the parking structure give architectural interest, shade parking spaces, and divert rainwater to an underground cistern. The water is then used for landscape irrigation.

The lower roof is planted with an extensive green roof to reduce storm water runoff and reduce wear and maintenance on the roofing membrane.



**Architect/Designer**  
HOK Architects

**Owner**  
GSA

**Developer**  
Opus Architects and Engineers, Inc.

**Project Area**  
595,338 sq. ft.

**Completed**  
February 2008

# college of dupage health & sciences center

Located in Glen Ellyn, Illinois, the College of DuPage (COD) is the largest single campus Community College in the US. The new consolidated laboratory and classroom reflects the College's Facility Master Plan which mandates energy and water reduction targets and requires environmental stewardship through the use of the LEED Rating system.

Use of prairie and native plants throughout the project ties the Health and Sciences Center into the surrounding prairie system that serves as both dedicated open space and as a teaching tool for the natural environment. The prairie system also plays a vital role in the university's overall stormwater master plan. Its design slopes to a campus-wide storm water detention pond system, treating the water along the way and eventually providing 100% of the campus' irrigation needs. All site irrigation is provided from the rain water detention ponds located just south of the building. The design team specified native and adaptive species of prairie grass to ensure conservation of the non-potable water source. The native vegetation and rain water detention ponds effectively treat pollutants and suspended solids from all site rainfall before it can be reused for irrigation.

The building is oriented for solar design; together with shading, punched windows, and efficient window glazing, the Health and Sciences Center has reduced cooling loads in the summer and heating loads in the winter. The lighting fixtures adjacent to the exterior walls have daylight sensitive controls; there is a displacement of ventilation system at the atrium and, heat recovery wheels as a best management practice; and photovoltaic panels are on the roof. Such strategies allow the energy management system to realize a 26% improvement from the ASHRAE 90.1-2004 baseline.

The use of low flow bathroom fixtures throughout the building results in a 34% potable water-use reduction from EPA baseline numbers. The College of DuPage Health and Sciences Center is targeting a LEED NCv2.2 Gold rating.



**Architect/Designer**  
HOK Architects

**Owner**  
College of DuPage

**Developer**  
Gilbane Building Company

**Project Area**  
595,338 sq. ft.

**Completed**  
Summer 2009

# constitution square

One and Two Constitution Square are commercial office buildings that comprise part of the initial phase of a 2.5 million square foot mixed-use project at the heart of the NoMa (North of Massachusetts Ave) neighborhood in Washington DC.

This site was previously a contaminated train yard requiring extensive soil re-mediation. Today, workers and visitors have multiple travel options as alternatives to driving. The newly opened New York Avenue Metro stop and elevated bike trail is adjacent to the site as well as major bus routes conveniently located within a couple of blocks. Designers made available bicycle storage, changing rooms, showers and a gym as well as preferred parking spaces for alternative and fuel efficient vehicles.

Both buildings feature extensive green roofs. They cover more than 50% of the building footprint and divert 25% of stormwater from the municipal system. At the ground level, low impact development (L.I.D.) planting beds capture and treat all of the stormwater routed from hardscape areas. Potable water demand is reduced 40% below the building's baseline through the use of low flow plumbing fixtures and by taking advantage of condensate captured from the roof top air handling systems and cooling towers. This water is used as an onsite greywater reclaim system to flush water closets and urinals in the building's core. Electricity use is reduced with the installation of energy efficient lights with daylight sensitive light controls and there are motion detectors to control the lights and CO2 detectors to control the HVAC settings both of which reduce energy use.

The facades feature high-performance glazing in aluminum-framed windows and curtain walls. The curtain walls primarily face North to limit excessive heat gain. The East, South and West facades feature large punched windows and pre-cast concrete columns and spandrels to provide shade and thermal mass. All of the buildings' exterior materials are quarried, sourced and fabricated within 500 miles of the project site. 74% of the construction waste will be reused or recycled and diverted from landfills. Finish materials such as: gypsum board; tile; carpet; and fabric wall panels; have a high post consumer recycled content, are sourced regionally, and contain low volatile organic compounds (VOCs) to improve the indoor air quality. Both Constitution Square One and Two are targeting a LEED CS v2 Gold rating.



**Architect/Designer**  
HOK Architects

**Owner/Developer**  
Stonebridge Associates

**Project Area**  
367,230 sq. ft. (One CS)  
642,230 sf (Two CS)

**Completed**  
Spring 2010

# fairfax village neighborhood center

The Fairfax Village Neighborhood Center is the first military project to attain LEED NCv2.2 platinum status. The master plans entails a smart growth design to reduce automobile usage as well as the preservation and restoration of open land. Additionally the design fosters a sense of community by creating a central core that encourages interaction. Compact development was essential; Fort Belvoir was expected to gain an estimated 19,300 additional employees in response to the Base Realignment and Closure Act (BRAC) of 2005.

Through the use of bio-retention ponds, extended detention basins, stormwater is naturally filtered and reduced through planted areas before being released into the municipal system. The enhanced quantity and quality stormwater controls reduce the flow of phosphorous and other contaminants and prevent erosion. Cleaner storm water for this site ultimately means cleaner streams and rivers to the Chesapeake Bay watershed.

The residential design include soy products to provide insulation. Energy-efficient compact fluorescent lamps provide lighting and solar panels and geothermal heat further reduce energy consumption. Granite-looking countertops are made from recycled aluminum shavings and cabinet faces come from wheat stalk while the units are made from sunflower husks.

Every new home is an Energy STAR certified house which means that the exterior envelope is better insulated and has less air infiltration than a house built using contemporary standards.

Fairfax Village is a 3,770 square foot building that incorporates features such as: floors made of salvaged wood, furniture that is salvaged and refurbished, kitchen cabinet doors made of sorghum stocks, kitchen countertops made of recycled metal shavings, millwork made of sunflower seed hulls, and counter tops in the great room made of recycled paper.

## **Architect**

Torti Gallas and Partners

## **Interior Designer**

HOK Architects

## **Owner**

US Army Corps of Engineers

## **Developer**

Clark Realty Capital and  
Pinnacle of Seattle

## **Completed:**

Summer 2009



The terrazzo tile on the bathroom floors contains recycled glass, the lobby floor is made of recycled porcelain tile, and the bathroom countertops are made of recycled plastic. The conference room floor is made of bamboo, 50 percent of the wood used in the project was Forest Stewardship Council (FSC) wood and brick was salvaged from existing buildings on site.

Energy saved is 60 percent below the ASHRAE standards. The on-site solar-generated electricity provides 22 percent of the electricity used by the building. Highly reflective roofing and a ground-source heat pump HVAC system with on-site vertical wells also contribute to the savings, along with efficient control systems and thermostats. Interior lights are controlled by occupancy sensors, while on the exterior full cut-off lights promote dark skies and reduce light pollution.

All paints, carpets and sealants were low-emitting. All of the composite wood products used contain no added urea-formaldehyde. Carbon dioxide monitoring devices ensure proper outside air ventilation, while potential contaminants are contained in areas such as the janitor's closet or the copy/fax room. Refrigerants and other chemicals used in the building are also low-ozone depleting.

# nasa building 29

Building 29 is the first new construction as part of the 2004 Implementation Plan expansion at the Johnson Space Center (JSC). The office building will provide space for approximately 520 people. One third of the space in the new building is for permanent relocation and the other two thirds will act as swing space for transitional employees as other buildings located at the Space Center are renovated.

The client initially assumed the new building would be over 100,000 square feet; however, through efficient planning, close analysis and deep understanding of the client's needs, the design team reduced the programming area by over 10%.

The site was carefully selected to be in the middle of the JSC campus located on what was a large existing surface parking area near shuttle routes and amenities in lieu of available Greenfield space. Parking spaces for building 29 were reduced and enhanced with landscaping to provide shading and pervious pavement. A bio-retention zone adjacent to the building will manage stormwater and provide a garden for building occupants.

The building floor plate is a bent bar with the long facades facing North and South and reduced glazed areas on the smaller East and West elevations. Glazed areas were minimized and exterior sun shades will further reduce the cooling load needs. There are solar panels on the roof which provide 100% of the domestic hot water heating. The thoughtful passive approach to the exterior envelope and building orientation works with the highly efficient mechanical system to exceed the target energy savings to 57.8% better than then ASHRAE 90.1-2004 baseline.

**Architect/Designer**  
HOK Architects

**Owner**  
NASA

**Developer**  
Gilbane

**Completed**  
EST Fall 2009

**Project Area**  
88,500 sq. ft





The Mechanical system includes an under floor delivery system, a heat recovery wheel, night temperature setback, ventilation demand using CO2 sensors, and direct digital controls.

The lighting design was also developed to minimize energy use with the incorporation of daylight responsive controls, occupancy sensors, timers, sensors, override switches, energy efficient lamps and high efficiency fixtures.

Water reduction and reuse were also goals. Low flow fixtures are planned throughout the building and condensate will be collected from air handling units for irrigation use. It is expected that during the hottest times of the year as much as 1000 gallons a day can be captured during peak cooling demand in the summer. This strategy coupled with the use of native and adaptive vegetation means that no potable water is used for irrigation. NASA building 29 is targeting a LEED NC v2.2 Silver rating.

# noaa

NOAA's series of curving wings mimics natural systems. Accordingly, the project's objectives include an environmentally sensitive, architecturally innovative and distinguished design using sustainable principles and best practices. Vertical and horizontal circulation, shared-use functions and the atrium are designed to encourage informal interaction between scientists and administrators.

The Design enhances the mission and values of the building user by minimizing the environmental impact of the new facility through a series of sustainable design strategies: water-sensitive site design; bio-retention; optimizing energy performance; daylighting and views; increased thermal comfort and control; enhancing indoor air quality and selecting building materials and finishes with a low life-cycle environmental impact.

Although there are no naturally occurring water features on the site, the landscape design creates a series of "Rain Gardens." These consist of pools, bioswales, rock gardens and planted areas in a semi-natural configuration that are both decorative and functional. The gardens and bioswales collect surface water runoff from the parking areas as well as overflow from the green roofs is needed. Depending upon the amount of rainfall these gardens can be wet or dry, and the water is designed to flow from one area to the next.

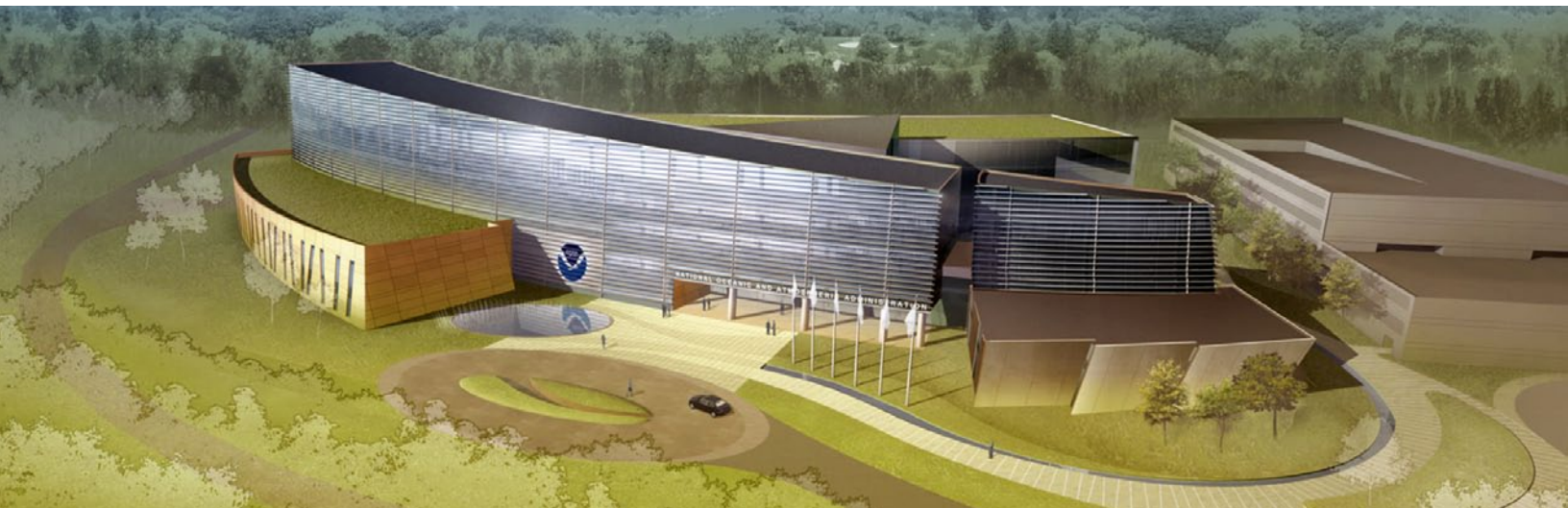
**Architect/Designer**  
HOK Architects

**Owner**  
NOAA

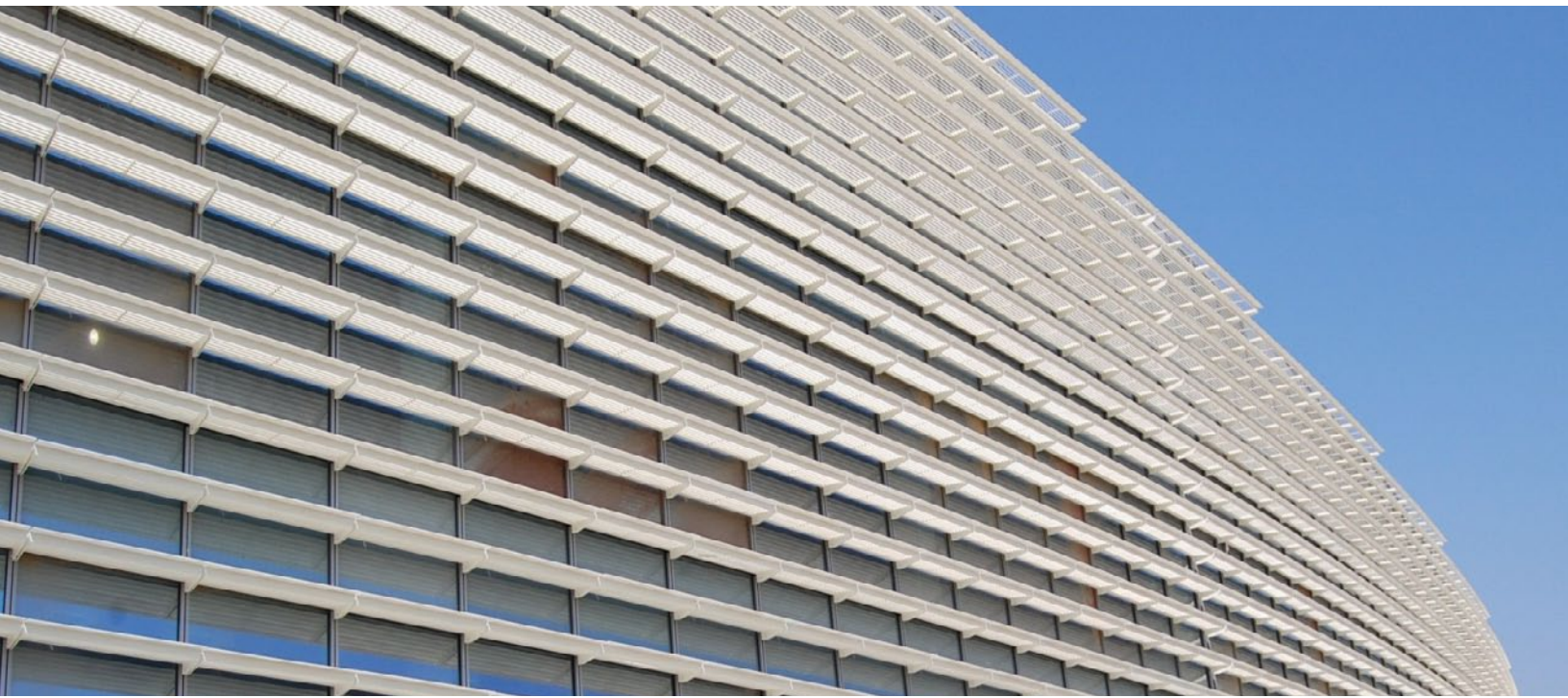
**Developer**  
Opus Architects and Engineers

**Project Area**  
268,762 sq. ft.

**Completed**  
EST Fall 2009







The main point at which water from the roof is collected is a unique waterfall scupper designed as a piece of landscape art and located between the main entry to the facility and the central atrium space. Over 50% of the roof surface is covered with an extensive green roof and the roofs are designed with as much consideration as the facades.

The project is in the watershed of Paint Branch Creek which is a tributary of the Anacostia River. In conjunction with the bio-retention areas on site, the green roof will improve the quality and decrease the quantity of the stormwater that enters the local systems. Maryland and Virginia as well as the District of Columbia view green roofs as one of the best strategies to help meet the EPA clean water rules.

Intelligent building technologies will actively respond to its occupants and environment. All of the engineering and data systems within the building will be integrated and controlled by the Building Automation System. Photoelectric dimming controls, occupancy sensors and sun shading devices are expected to reduce energy costs significantly. The whole building design including efficient light fixtures and mechanical equipment will have 32% energy savings below the ASHRAE 90.1 1999 standard. Energy saving is further enhanced by the basic orientation of the building which is primarily North-South and the design of the facades including two feet deep exterior horizontal sunshades which will minimize the use of energy for cooling in summer and heating in winter.

The control systems also give individual users more control of their immediate work environment providing improved comfort levels to the 700-800 staff. The underlying design concept is the notion of a building that actively responds to environmental conditions, just as its users observe and predict surrounding and natural conditions. NOAA is targeting a LEED NCv2.2 Silver certification and an ENERGY STAR performance rating.

# santa clarita maintenance facility

Santa Clarita is located northwest of Los Angeles and 45 miles from the Pacific Ocean coastline with a population of 177,000. An eco-charette identified sustainable goals and strategies such as energy efficiency and water conservation. Although the initial interest to use straw bale construction was its high R value, ultimately, the decision arrived by way of multi-criteria analysis (MCA). For instance: straw bale helped to create a healthy work environment absent of harmful chemicals or VOCs, it diverted local agricultural waste from the landfill, it was locally available, and it produced an aesthetically pleasing and low maintenance long lasting building for the owner at a cost that was comparable to standard wood framing. At the end of the building's life, straw bale can be composted.

The team was able to produce a design that exceeds California Energy Code Title 24 requirement by 44%. The client also participated in the "Savings by Design" program offered by Southern California Edison, the local utility company. Through this program the owner is able to receive monetary incentives based on the buildings energy

**Architect/Designer**  
HOK Architects

**Owner**  
City of Santa Clarita, CA

**Project Area**  
66,700 sq. ft.

**Completed**  
May 2006





performance. In part, the above goal was met by the design of a very efficient mechanical system; a series of water source heat pumps supplied by chilled water generated at an onsite cooling plant, a super insulated envelope to reduce cooling loads, and an under floor delivery system to only cool the first seven feet of air above the finished floor.

In addition, a night time outside air flush takes advantage of the 40 degree difference between daily high and low summer temperatures to pre-condition the air, and natural daylighting reduces the reliance on electric lighting. As a result, the associated heat loads minimizes energy use.

The facility installed low flow fixtures and a xeriscape garden design. The bus washing station filters the water with a cyclonic filter and reuses it for bus washing therefore greatly reducing water use in a water intensive activity.

Prompted by the fact that it had one of the worst measured air qualities of any city in California and the enactment of the new State's Clean Air Rules, Santa Clarita set goals to reduce its air pollution. The facility included publicly available CNG fueling stations on site to encourage the popularity of private vehicles fueled by CNG as well as 28 bike racks and 6 showers to promote bicycle commuting for staff. The Santa Clarita Maintenance Facility achieved a LEED NC Gold rating from the USGBC.

# usda

USDA requested a new laboratory to house up-to-date research and testing techniques and consolidate its three major divisions: Animal and Plant Health Inspection Service (APHIS), Agricultural Research Services (ARS), and Center for Veterinary Biologics (CVB). Their goal was to promote enhanced collaboration amongst the different departments.

The new BSL-3 laboratory building is adjacent to existing buildings. A cost analysis in early design assessed that an atrium would be less expensive than constructing an additional area of exterior wall. The circulation on the upper floors is open to the atrium which can be used as a flexible meeting space to accommodate up to 800 people. Directly under the glass ceiling are baffles with sensors that track the sun and decrease glare in the atrium.

The offices, training rooms, conference rooms, dining area, libraries are designed with access to natural daylight; the artificial lighting in these areas have controls that are sensitive to the amount of daylight entering the spaces. Daylight modeling tested various strategies to optimize daylight into the building using aperture sizes, locations and light shelves.

Prior to construction, the groundwater on site was discovered to be contaminated with 1,4-dioxane. Several conventional technologies were studied or tested to determine best treatment options. It was decided that the groundwater should be removed and treated within an advanced phytoremediation system to improve and accelerate remediation. This process allowed USDA to bioremediate without the need to excavate the contaminant material and dispose of it elsewhere. The ground water was placed in a containment structure north of the building where naturally occurring organisms remediate and preserve the natural state of the surrounding environment

The site was designed with bioswales and the building has a green roof to reduce the quantity and improve the quality of stormwater runoff. The planting list was selected with drought tolerance in mind to eliminate the need for using potable water for irrigation.

The USDA building is LEED NC certified by the USGBC.



**Architect/Designer**  
HOK Architects

**Owner**  
USDA

**Project Area**  
530,000 sq. ft.

**Completed**  
2009

# noaa coastal services center's habitat priority planner

NOAA's Coastal Services Center provides a tool to review alternatives for coastal development that quantifies economic, environmental, and social impacts. The "Habitat Priority Planner" looks beyond smart growth and towards a perfect balance between the natural and built environment by preparing and analyzing hypothetical development scenarios.

For example, in coastal Georgia, NOAA worked to integrate life cycle concepts, consensus-based standards, and performance measurement and verification methods into three hypothetical designs: conventional, new urbanist, and conservation scenarios. The approach used local partners and science-based skills and technologies to evaluate each. From there, the team began with a list of potential economic, environmental, and social indicators to measure hypothetical impacts from the various scenarios on the surrounding environment. Factors such as whether or not the site location was within a region or watershed were important. As the project moved forward, the team discussed and refined its indicators - life cycle analysis, local consensus, performance measurements and verification methods all influenced the achievement of a sustainable development.

Rather than jumping to an assumed "less bad" approach, this process focused on a coalition of views and indicators in order to omit dictation of judgment from a single stakeholder category. This structure assesses multiple value systems and objectives, not easily quantified, to develop a scenario that works best for the community and its surrounding environment.

You can view these project results on NOAA's Web site at: (<http://www.csc.noaa.gov/digitalcoast/tools/hpp/>). The Web site is structured to allow users to walk through the project processes and results. It is a valuable educational tool that provides information and promotes dialog with local government officials, planners, developers, and citizens in the communities they serve.



# the wild center

The Natural History Museum of the Adirondacks or the Wild Center is located on a 32-acre site that was previously an open cut sand quarry. The team minimized disturbance to the existing natural habitat and restored more than 55% of the quarry's site. Today, the center is a living museum that provides interpretation and observational experience for its surrounding environment. The vision for the Wild Center is a building fully integrated within the natural setting of the Adirondacks; blurring the division between the outdoor environment and the interior space and exhibits.

Water is the central, organizing element of the museum's conceptual and technical design. A three acre pond serves as the anchor to the functional and aesthetic design of the building. It is linked to the Wild Center's four water based exhibits to organically break down the nitrogen cycle within the 5000 gallons of exhibit water. The direct adjacency of the building to the pond minimized piping so that more of the site could be restored to its natural habitat.

**Architect/Designer**  
HOK Architects

**Owner**  
Natural History Museum Of  
Adirondacks

**Project Area**  
54,000 sq. ft.

**Completed**  
2008





The pond is also an integral part of the storm water management system. It provides a primary phase in the water cycle. For example, 1,823 cubic feet of stormwater is annually reduced via evaporation - recycling the stormwater naturally deters the potential burden upon the local municipal system. The 2,400 square foot vegetated roof, pervious pavement, and infiltration trenches, filter the remaining stormwater of pollutants and further reduces runoff volume.

The museum is designed in an indigenous Adirondacks style using nearly 22% locally available materials. White pine for the exterior siding was harvested and milled in Tupper Lake, less than 10 miles away; Red Garnet and Champlain stone come from quarries in the park. The metal roofing, concrete and structural steel were supplied and fabricated in local plants. Nearly 50 percent of construction waste was diverted from local landfills and GreenSeal certified finish materials provide a healthy indoor environment.

10% of the museum's power comes from a 40kw photovoltaic array on the roof of the Bio-Building. The museum's design and orientation maximizes the use of year-round natural light. Energy-efficient lighting and controls combine with a well-insulated building envelope contribute to create a highly energy-efficient building. A building management system allows for constant monitoring and improvements. Composting toilets help reduce water consumption by more than 30,000 gallons annually. Overall, these and other strategies have reduced water usage by more than 30%. The Wild Center achieved a LEED NC Silver rating from the USGBC.

organizations

adobe • burts bees • the green  
recycling network • heifer inter  
national • seventh generation  
whole foods • zipcar • adobe •  
urts bees • the green recycling  
network • heifer international  
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Adobe is committed to conserving natural resources and minimizing their impact on the environment. They actively implement measures to increase efficiency, conserve energy and water, improve air quality, and reduce waste.

Where possible, Adobe uses recyclable materials. Adobe communicates environmental policies and programs to Adobe employees to ensure that all employees are aware of their role and responsibility to fulfill and sustain Adobe's environmental commitment.

Three key initiatives within Adobe's environmental sustainability effort are their office building operations, waste management program, and their product packaging.

## Office buildings

Adobe's headquarters spans three office towers that comprise over one million square feet of office space, making it the largest corporate presence in downtown San Jose. Over the past several years, Adobe has initiated over 70 separate energy and water conservation projects to improve the site's environmental sustainability. The effort has reduced indoor water use by 22%, landscaping water use by 76%, electricity by 35%, and natural gas by 41%.

These documented improvements earned the site three Platinum LEED Certifications from the U.S. Green Building Council, ranking it as one of the most environmentally sound business facilities in the world.

## Waste management

The approximately 2,100 employees headquartered at Adobe's San Jose campus actively engage in recycling and composting programs that divert up to 95 percent of the site's solid waste from landfill. Paper, cardboard, plastic, glass, cans, printer toner, and batteries are recycled, and food waste is composted.

Similar programs are being deployed and expanded where possible throughout Adobe's more than 80 facilities worldwide. Additionally, Adobe has established PDF as an ISO standard to promote paperless business processes.

## Product packaging

As one of the largest providers of boxed software in the world, Adobe is uniquely positioned to reduce the impact of product packaging in their industry. The company recently launched an environmentally sensitive redesign of its software packaging based on a comprehensive evaluation of packaging materials, production, transport, use, and disposal.

The resulting packaging, which is being phased in across the Adobe product line, combines recyclable cardboard derived from sustainably managed forests, a die-cut production method and folding inserts to minimize glue use, and reduced size and fewer inserts to limit materials use.



# burt's bees

Burt's Bees released their first Corporate Sustainability Report (CSR) in 2009. While there was a shortage of hard core measures in some of the operations, Burt's Bees wasn't discouraged from writing their first account. They recognized that when it comes to practical metrics, consistent measures and grounded goals were priority.

In 2006, Burt's Bees partnered with Sunoco to recycle all of their company waste through their company-wide recycling program. Now, not only is all office waste recycled, but much of the waste from manufacturing is picked up for recycling by Sunoco.

## **Burt's Bees 2009 Sustainability Goals:**

- Water Reduction: <700,000 gallons non-product water, <750,000 gallons waste water
- Energy Reduction: <5GWh of total electricity consumed across all buildings
- Waste Reduction: <90 tons of solid waste to landfill

## **Burt's Bees 2020 Sustainability Goals:**

- Zero waste
- 100% Employee Engagement
- 100% Natural Products
- 100% Post Consumer Recycled (PCR)/Biodegradable packaging
- 100% Renewable Energy/Zero Carbon LEED Certified Buildings

Burt's Bees is committed to business and manufacturing processes that supports their pledge to do the right thing when it comes to products, the environment and fellow living creatures.

## Green Buildings

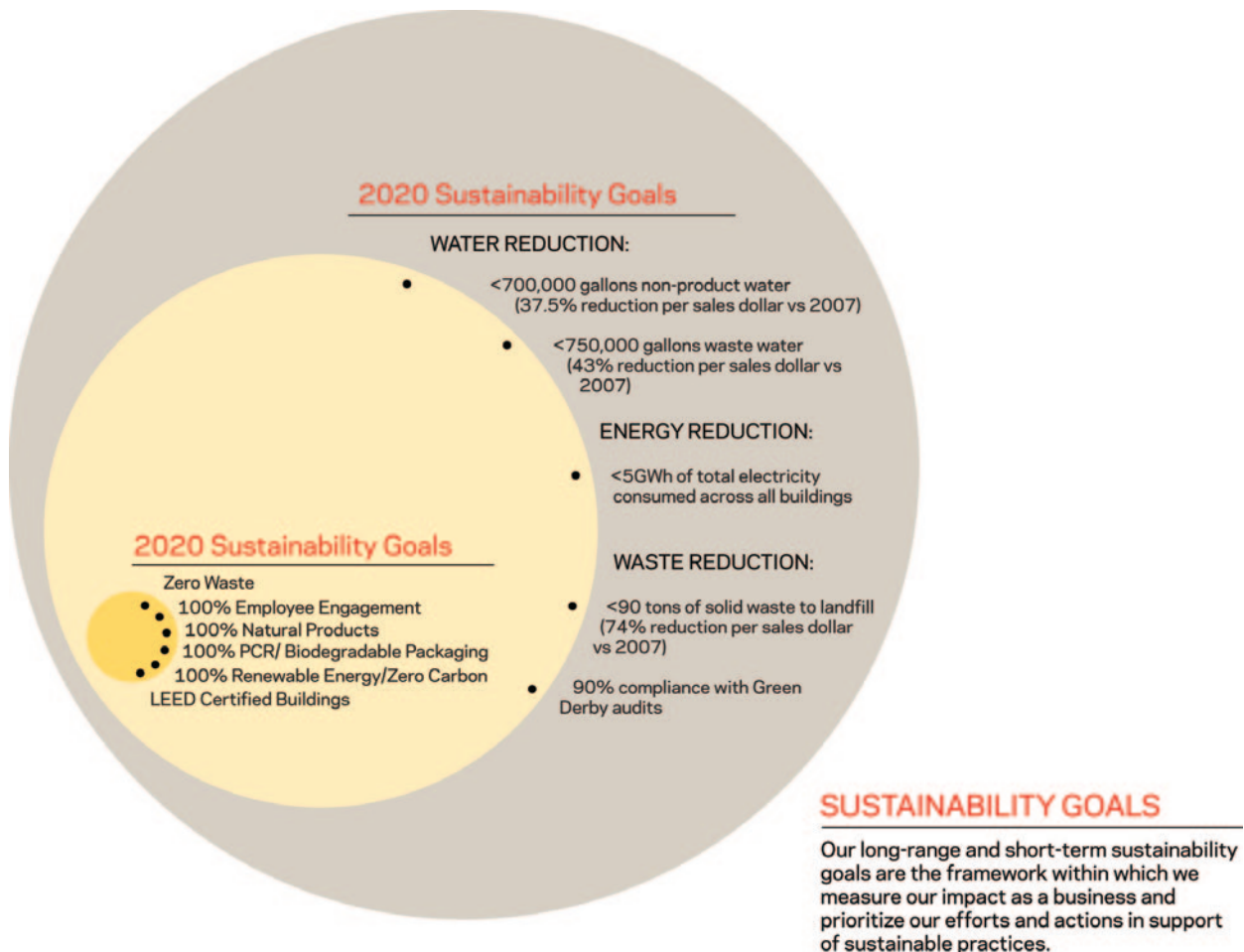
Currently, Burt's Bees leases their office, factory, and warehouse buildings which puts some restrictions on their efforts toward ensuring they're LEED certified. However, they are working with their office management to make improvements where possible; in 2008, they added new office space in a former distribution warehouse that is much greener. Updates will be provided in their CSR.

## Waste

Burt's Bees recently hosted a "dumpster dive" event to teach employees about waste reduction. It was quite an education when they combed through every inch of their waste!

Until 2007, they were only recycling their used white paper and mixed plastic, glass and aluminum. They had also been sending certain organic by-products from their production processes off-site for compost.

Today, in addition to all of the items above, they also recycle wood, corrugated cardboard, shrink wrap chipboard, and fiberboard. And, they've begun composting the residue from their wastewater pre-treatment process. Even their offices, break rooms now have composting bins, as well as reusable and compostable utensils—they're made from potatoes!





SCOTT SHEPARD :

# the green recycling network

Green Recycling Network (GRN) provides full deconstruction services of commercial buildings using a disassembly process with the objective of recovering materials for re-use. The costs and methods are competitive with traditional demolition methods, but the recycling results are more extensive. GRN landfill diversion rates regularly exceed 90% of materials such as carpeting, drywall, metal, ceiling tile, stained/painted wood, glass, etc. while following EPA's comprehensive guidelines for construction, and renovation. Deconstruction of buildings requires that each new employee study continued safety and efficiency standards. Deconstruction is a closed-loop process that uses less energy, raw materials, and generates less pollution than the average demolition and continues the life of the material. GNR takes advantage of its sister recycling/waste company, ACE Recycling, and partnerships with manufacturers to create additional opportunities for recycling where re-use is no longer an option.

GRN's process is cost effective relative to traditional demolition because of their ability to avoid costly land disposal fees by leveraging the expertise of the Green Recycling Network. Thus, no matter the job or the mix of materials, clients get green results even when a project involves a diverse mix, such as reusable items, painted drywall, unusable furniture, carpet, ceiling tile, and even mixed debris.

GRN uses their own recycling facilities, equipment and labor in combination with their network to find the most efficient and financially beneficial outlet for all materials from a project. These facilities are designed to efficiently process a diverse range of construction and demolition materials for recycling, and salvage materials for reuse. These facilities handle significant volumes of recycling and reuse materials which result in further efficiencies.

The materials include salvage, such as building materials, electrical and mechanical equipment, furnishings and other materials. Items that cannot be salvaged at a higher value than scrap are recycled at prices less expensive than landfills.

## Green Clean

Green Recycling Network “Green Clean” services are an innovative method by which materials are removed from buildings without demolition. Many commercial buildings store materials and equipment that are no longer used but could be recycled or reused by other organizations. GRN crews remove all unnecessary items and prevent them from going to landfills, maximizing their value in back-end markets. Items such as mechanical and electrical equipment, furnishings, office equipment and building materials can raise significant revenue that is shared with the building owner. Other items that have no reuse value can be recycled by the GRN recycling facilities.

A sample list of materials that GRN was able to place in reuse markets:

- 500 rolls of carpeting from an old abandoned warehouse. The cost to the building owner was zero while a landfill would have incurred thousands of dollars in disposal costs. From an environmental standpoint, carpeting is plastic and simply will not decay in landfills causing permanent harm to the ground.
- Raised IT flooring systems. Raised flooring systems are often filled with wood or concrete cores in order to reduce noise which prevents recycling in many cases. GRN has developed a reuse market for these flooring systems.
- 13,000 sq. ft. mezzanine system. This mezzanine systems was planned for metal recycling, but GRN more than quadrupled the value by finding a reuse market for it.





Photos courtesy of the Green Recycling Network.

- Electrical and Mechanical equipment. GRN has sold hundreds of mechanical and electrical equipment items—the market value far exceeding recycling values. Frequently, the reuse market can result in extensive cost savings, by requiring buyers to pay for the removal and shipping of items in addition to the item purchase.
- Laboratory equipment and furnishing. GRN has sold hundreds of lab equipment components and furnishing to the highest paying buyers. GRN network of buyers are located throughout the world which results in values that far exceed normal expectations.
- Often value is achieved by finding a reuse market that is not able to recycle efficiently. Lighting is a common example. The bulbs of 2 x 4 recessed lights that are found in office buildings contain mercury and the ballasts may obtain PCBs. The hazmat costs result in an expensive disposal. GRN has sold thousands of these fixtures and attached lights to reuse markets, with zero disposal cost.
- Doors and windows. GRN finds reuse markets for these materials versus recycling.
- GRN customers receive the direct benefits of GRN's buyer network. The reduced cost or revenue results in significant dollar value and the added benefit of knowing materials are being reused or recycled and therefore, diverted from landfills.

## Waste Audit

GRN's waste stream audit service is used to identify the quantities of materials that come out of buildings. Initially, a baseline audit is conducted and provides a benchmark by which future improvements against waste produced and volumes recycled are gauged.

Interview with Scott Shepard  
The Green Recycling Network, June 8, 2009

# heifer international



[www.heifer.org](http://www.heifer.org)

Heifer International is a non-profit organization that provides livestock to poor families in developing nations to use for farming, food production, and fertilizer. In addition, they teach animal husbandry and skills for flexible and sustainable rural farming. The idea: empowering communities with resources and education toward self-sufficiency is a better long-term solution than handouts for fighting hunger.

Heifer International is headquartered in Little Rock, Ark.; however, more than 125 locations worldwide serve as “home base” to 600 office and field staff. Striving to end hunger and poverty while caring for the earth is a full-time job, and the success of Heifer’s mission depends on a far-reaching network of committed individuals working together to fulfill their mission.

Two and a half years ago, ground was broken on an abandoned brownfield next to the Arkansas River for Heifer International’s new World Headquarters. Former President Clinton praised Heifer’s more than 60 years of work helping the hungry by saying, “You have to have a world with more partners and fewer enemies - and one by one, that’s what Heifer does.”

The opening of the four-story, 94,000-sq.-ft.. office building accomplishes the first phase of a three-phase development of the 33-acre Heifer International Center campus, which will eventually include an educational facility, the Polly Murphy and Christopher Keller Jr. Education Center, and a Global Village to educate the public about pragmatic solutions to hunger and poverty here and abroad.

## Green or Sustainable Features:

Sustainable concepts apparent in the building are extensions of Heifer’s approach to ending world hunger, guided by a belief that education comes through environmental connections. Reclamation and use of damaged land, collection and reuse of water, and equality and access for all people to healthy conditions were key goals that created the intended symbiotic relationship between building and land.

A stated goal that zero water leave the site led to a process of restoring a wetland on an abandoned railroad switching yard that would collect and clean stormwater for reuse. A connection is drawn architecturally between the movement of people and the movement of harvested rainwater. The connection between people and building continues through vertical circulation design and facade fenestration, recycled materials used from on site, and carved breezeways under the building, all interrelated with building systems.

The narrow, semi-circular floor plan results in daylight and views for all 474 employees. The views focus on the adjacent riverfront park and wetland.

The building is designed to use up to 55 percent less energy than a conventional office building.

**Heifer International Headquarters is a LEED NC 2.1 Platinum Building.** Building tours are available twice daily, Monday through Friday, beginning at 11 a.m. and 3 p.m.

## Practicing What They Preach

“If we’re going to have a lasting impact on ending world hunger, then everything we do must renew the earth and not deplete it,” said Jo Luck, Heifer’s president and CEO. “It’s true whether we’re working with people who want to be self-reliant or managing their own worldwide operations. Nurturing the environment while combating hunger has always gone hand-in-hand at Heifer.”

## Recycling from the Ground Up

So they started with the earth itself, purposely selecting land that had once been a railroad switching yard but at that time lay dirty and dormant, with abandoned warehouses and industrial structures blighting the landscape.

They cleaned the existing brownfield, by removing 75,000 tons of earth; and transformed it into a wetland area that controls, stores and reuses surface groundwater. And an innovative, permeable-surface parking lot next to the building eliminates common stormwater runoff problems.

Even the abandoned buildings nearby received a second chance: almost all of the masonry was crushed into gravel and reused, along with recycled steel, in the new construction. And instead of wood from old-growth forests, some of the building’s flooring is made of recyclable, fast-growing bamboo, and the rest is covered with recycled carpeting.

## Relying on Mother Nature’s Water...

Along with the wetlands’ collecting and filtering systems, the new headquarters includes a water collection tower. With the roof sloping to direct rainwater to drains and then stored in the tower, the center is able to rely on the water falling on the property, instead of on the municipal water system.

## ...And Sunlight

And the headquarters’ narrow, 60-foot-wide design and glass skin allow staff to work in natural light, with “light shelf” overhangs minimizing heat in summer and maximizing it in the winter. As darkness falls on the day, sensors adjust interior lighting to maximize energy savings. Energy-saving ductwork and modular electrical conduits and mechanical systems run beneath the floors.

Bottom line? The building uses 52 percent less energy than a conventional office building of similar use and size. And this design has already attracted the attention of architects and builders.

## Sound Business Decision

For Heifer’s far-flung Little Rock staff, the new building enables everyone to convene in one place, saving money spent on inhabiting three separate facilities, and permitting more efficient administration. Based on current projections, the project should pay for itself in ten years.





*"Bernalillo, New Mexico."*

*Photo Credit: Jonathan Herz*

But perhaps best of all, the Heifer International Center will become a focal point for hunger education in America – a place where they'll host seminars, conferences and working sessions on world hunger issues. Each visitor who enters the campus will see firsthand how they can all help end hunger and poverty by becoming better stewards of the planet.

"It's important that what we profess and what we do are in agreement," said Gerald Cound, former facilities director for Heifer. "[With this building], we are assured that we can tell our story with integrity, and that we are taking a leadership position in this important movement to decrease our footprint on the earth."

## Agroecology and Sustainability

In a world where land is overused, community members need to learn how to protect and rejuvenate their land, water and other natural resources. Heifer helps by teaching environmentally sound agriculturally sound techniques.

## Awards

- Heifer International received the 2006 Social Capitalist award from Fast Company magazine.
- Heifer International also received the 2004 Conrad N. Hilton Humanitarian Prize for its efforts to eliminate hunger and help communities become self-sustaining. It was the first US-based organization to win the \$1 million award since 1997.
- In 2003, Heifer International was named one of Forbes magazine's top 10 charities.
- In 2007, the Heifer International Headquarters building was named one of the American Institute of Architects Committee on the Environment Top Ten Green Projects.
- In 2008, the Heifer International Headquarters building was named a National AIA (American Institute of Architects) Institute Honor Award Winner
- In 2008 the Heifer International Headquarters building was awarded a LEED NC 2.1 Platinum certification by the USGBC.

# seventh generation

Seventh Generation, a manufacturer of natural household and personal care products, has sustainability and corporate social responsibility woven deeply into the fabric of their business. For the last several years Seventh Generation has identified global imperatives which they can affect in order to focus these efforts. While there have always been sustainability related initiatives happening across the company, Seventh Generation is now using this process to develop more specific longer term companywide sustainability goals which will be used to prioritize initiatives through developing departmental goals for the next 1-2 years. All of these goals will dovetail with the annual strategic planning cycle.

While most of the sustainability initiatives are initiated internally, Seventh Generation is involved with many associations that help foster them. Partnerships with organizations like Greenpeace and Healthy Child Healthy World have been very beneficial. Also enlightening has been the certification process for their headquarters building which has recently been awarded LEED Gold for Commercial Interiors.

As an alternative to buying carbon offsets, Seventh Generation has invested in reducing their carbon footprint and using renewable energy. Seventh Generation has launched the 20/20 program which sets a goal of 20% reduction in carbon emissions and to use 20% renewable energy by 2010. While these are goals for their business, Seventh Generation encourages their employees to continue their sustainable thinking outside of the office by offering incentives for employees who use public transit or bicycles to commute. All employees are provided a free home energy audit and a carbon tracker to monitor their carbon information, and various incentives for home energy efficiency improvements and purchasing fuel efficient vehicles.

Manufacturing of Seventh Generation products happens through a network of partners, and not in their own facilities, so they look beyond their own direct consumption when considering environmental and social goals. Seventh Generation maintains a hands-on approach by performing sustainability audits of manufacturing partners in their supply chain. The audit looks at 14 categories related to sustainability and social responsibility. Criteria evaluated include environmental considerations as well as social such as how



the companies treat their workers. Seventh Generation likes to work with manufacturers as partners and uses the audit process to drive improvements in corporate consciousness practices of those companies. Because other large consumer brands are manufactured in the same facilities as their products, Seventh Generation only has so much power over the way the supply chain facilities do business. That doesn't hinder the company from using the audit process to drive change. David Rapaport, the Senior Director of Corporate Consciousness says "If they are making products for us that are not using any toxic components, we know that we are making a difference in improving the work environment for the manufacturing plant as a whole."

Seventh Generation completed their first ever traceability study for all cleaning products and traced 95% of all cleaning ingredients to find out where they come from to create a greater understanding of environmental impacts throughout the supply chain. This supplements extensive standards for the health and environmental characteristics of products used in selecting ingredients and formulas. Distribution is studied closely by the logistics team; reducing miles travelled and increasing post-consumer recycled content used for packaging are continuous efforts.

On the social front donations increased by 91 percent in 2007 and established a corporate giving program to donate 10% of pretax profits annually. The company also gives interest-free loans to help employees become more energy efficient and reduce their carbon footprints. All employees have access to a \$5,000 forgivable loan towards the purchase of fuel-efficient cars and for home improvements. There is also an annual \$500 award for Energy Star purchases that employees make for their own homes.

Behind the scenes at Seventh Generation, there is an extensive orientation that all new hires receive. Topics ranging from green chemistry to systems thinking - employees are reflecting on sustainability in everything they do.

*"This notion of having sustainability embedded into the core purpose of the business is very important. It has enabled us to do what we have done. We've been able to do things we never would have had sustainability been an add-on to our business model..."*

*Seventh Generation feels that the real opportunity to make progress on sustainability is while fundamental business decisions are being made."*

*Interview with Dave Rapaport - Senior Director,  
Corporate Consciousness, Seventh Generation*

Due in large part to these initiatives, in 2007 Seventh Generation helped the environment by:

- Saving 118,000 trees;
- Reducing water use by 42,000,000 gallons;
- Saving 29 billion BTU's of energy;
- Saving 213 billion gallons of petroleum;
- Decreasing normalized greenhouse gas (GHG) emissions by 34% from 2005.

# whole foods

Their motto — *Whole Foods, Whole People, Whole Planet* — emphasizes that their vision reaches beyond food retailing. In fact, Whole Foods believes its deepest purpose as an organization is helping support the health, well-being, and healing of both people — customers, team members, and business organizations in general — and the planet.

The mission of Whole Planet Foundation is to create economic partnerships through microcredit with the poor in communities that supply Whole Foods Market stores with products, with a focus on the developing world.

## Wind Power

In January of 2006, they made their first landmark purchase of renewable energy credits from wind farms to offset 100% of the electricity used in all of their stores and other facilities in the United States and Canada. This green action and others earned them the Environmental Protection Agency Green Power Partner 2006 and 2007 and Power Leadership Award in 2004, 2005, and 2006.

## Solar and Biomass

Individual stores from several regions supplement their wind credit purchases with power from solar panels and power generated by biomass. Whole Foods feels that a typical solar installation can:

- Produce and save more than 2.2 million kilowatt hours over 20 years
- Result in more than 1,650 tons of CO<sub>2</sub> emissions avoided, the equivalent of removing 440 cars from the roadways
- Reduce the impact on the country's power grids

In 2002, their Berkeley store became the nation's first major food retailer to introduce solar energy as its primary lighting power source. More of their stores followed suit; for example their Brentwood, California, store uses solar energy for 24% of its power source and their Edgewater, New Jersey, store boasts an impressive array of 14,000 square feet of solar panels providing more than 20% of the store's power needs.

## Green Building

Green building techniques conserve natural resources by reducing the use of virgin raw materials and minimizing the amount of toxic resins and volatile organic compounds (VOCs) off-gassed by traditional building materials such as laminates, paint and carpeting. Their store in Sarasota, Florida, received LEED Silver Certification by the United States Green Building Council (USGBC), the first environmentally-friendly supermarket designed in accordance with the LEED Green Building Rating System®.

New store construction includes innovative green materials such as MDF (medium density fiberboard), made from 100% recovered and recycled wood fiber, Marmoleum, a natural linoleum product and FSC (Forest Stewardship Council) Certified Wood.

## Other Green Initiatives

In addition to the major efforts listed above, Whole Foods is also committed to:

**Biodegradable food packaging** — They are in the process of replacing traditional plastic and paper prepared food containers and utensils with all-natural fiber packaging that is environmentally friendly. Made from renewable resources such as sugar cane pulp, corn starch and bamboo, they are completely compostable and, because they are unbleached, free from chlorine and dioxins.

**Biodiesel** — They are gradually converting their truck fleet to biodiesel fuels, reducing CO2 emissions into the atmosphere. Their fleet is also being fitted with aerodynamic aprons to cut down on wind resistance resulting in less fuel consumption. These trucks also use a fuel-saving (and emissions-cutting) system that allows the engine to be turned off completely at loading and delivery, rather than idling.

**Water Conservation** — Some stores have converted to flush-less urinals; each will save approximately 40,000 gallons of water per year (average use).

**5% Day Donations** — 5% Days are Whole Foods' way to give back to the community. On designated days throughout the year a total of 5% of the day's net sales are donated to a local non-profit organizations.

**Cleaning Supplies** — Some stores are using Green Seal certified cleaning supplies and others are transitioning to the use of environmentally friendly cleaning and maintenance products.

**Printing Standards** — They carefully evaluate the need for everything they print, and when they do print, they insist on recycled paper, soy inks and solvent-free printing processes.

## Local Producer Loan Program

Whole Foods Market's Local Producer Loan Program (LPLP) provides up to a total of \$10 million in low-interest loans to small, local producers.

Loans range from \$1,000 to \$100,000 and can be for things like purchasing more animals, investing in new equipment or converting to organic production. They minimize fees, interest rates and paperwork.

Current loan recipients range from ranchers and beekeepers to ice cream makers and bakers.



Whole Foods,  
Whole People,  
Whole Planet



## Seafood Sustainability

Whole Foods is committed to responsible seafood practices, including:

- Buying seafood from responsible, certified fisheries.
- Using the blue Marine Stewardship Council sticker on seafood packaging is a good place to start.
- Supporting fishing practices that ensure the ecological health of the ocean and the abundance of marine life.
- Partnering with groups that encourage responsible practices and provide the public with accurate information about the issue.
- Operating their own well-managed seafood facilities.
- Helping educate their customers on the importance of practices that can make a difference now and well into the future.
- Promoting and selling the products of well-managed fisheries.

## Locally Grown: The Whole Foods Market Promise

Where available, Whole Foods is committed to buying from local producers whose fruits and vegetables meet specific standards, particularly those who farm organically and are themselves dedicated to environmentally friendly, sustainable agriculture.



*Courtesy of Bigg Riggs Farm*

## Additional efforts in process:

<http://blog.wholefoodsmarket.com/author/loftusk/>

- Supporting Marine Stewardship Council seafood and Forestry Stewardship Council wood.
- LEED gold for one of their recently opened stores and have 20 plus stores registered with USGBC for certification at various levels.
- Banning plastic bags and polystyrene from packaging.
- Installing the world's first fuel cell at a supermarket (Glastonbury, CT),
- Numerous solar installations in the works.
- Partnering with Department of Energy (DOE) to develop the Commercial Lighting Solutions Program and a host of other programs
- Moving closer to zero waste with many regions diverting more than 80% of waste by recycling and composting.
- Conducting Sustainable Packaging Forums with vendors and providing compostable food containers for their prepared foods venues.
- Implementing many energy efficiency programs: near real time enterprise energy monitoring and reporting (some sub-metering), installed doors on some medium temperature cases, testing LED lighting in refrigerated cases and other applications
- Feasibility testing of an on site wind turbine for the Pigeon Cove Seafood Processing Facility in Gloucester, MA
- Site renewable (waste to energy) energy project for the North Atlantic Region's Commissary in Everett, MA



*"San Mateo County Sheriff's Forensic Laboratory and Coroner's Office, San Mateo, California." Photo courtesy of HOK.*

# zipcar

Zipcar started in September 1999 in Cambridge, Massachusetts and is the world's largest and fastest growing car sharing club. Over the last 6 years the company's annual revenues have grown from \$2 million to \$100 million. Zipcar currently has 300,000 members and approximately 6,000 cars in London and North America. Carbon emissions from transport account for a significant proportion of the global total, so the more travelers that can hop on a bus or choose to walk the better. However, for the times when a car is necessary, Zipcar steps in.

Behind the scenes, every Zipcar office has a recycling policy to cover paper, cans, bottles, etc. Additionally, all offices make a concerted effort to do as much electronically as possible in terms of communications and processing. Zipcar has utilized relationships with Clean Currents, USGBC, and UrbanTrans to further position themselves as an environmentally friendly company.

Zipcar rolls out a quarterly survey to gather member feedback that ultimately results in many of the forward facing programs that have been initiated. Zipcar continuously alters its behavior based on client feedback. A great example of this is that many members have recently expressed a desire to reserve and edit reservations via text message. In response, Zipcar has developed software to incorporate a 2-way text message system into the reservation process, and this will soon include reminders of Zipcar's "6 Rules of the Road" which provide guidance to members on car treatment policy. Zipcar is also developing an iPhone application that will be available soon for a free download as yet another avenue for members to make reservations.

Zipcar has an extremely active membership and is continuously hosting events ranging from member appreciation nights to "Green Confessions". "Green Confessions" is a social event where members write down their "secrets" or "confessions" on what they've done recently that wouldn't qualify as environmentally friendly behavior. These confessions are then written on a whiteboard for all to see. Another interesting program is Zipcar's "Low Car Diet" which encourages members to ceremoniously donate their keys for 30 days and in return, receive rewards like free Zipcar use for a month, or a discounted membership to a public bike sharing program called SmartBike.

Zipcar's sustainable policies carry over to their fleet management as well. Zipcars in Washington, DC are cleaned every nine days using environmentally-friendly cleaning products and a maximum of three gallons of water per wash. In Alexandria, Virginia, cars receive waterless car washes using only environmentally friendly cleaning products. In addition, Zipcar has committed to ensuring that their fleet maintains an average fuel efficiency of 28 miles per gallon. Beyond filling a niche of urban and sub-urban dwellers who don't want to own a car, Ellice Perez of





Zipcar notes that, “Zipcar is actually creating its own niche by changing behavior.” Users are more likely to take a walk or bicycle to get to their destination, resulting in a healthier population. While cars are not going to disappear from city streets overnight, a steady reduction in road use will help the planet and could give people a better quality of life.

### Interesting Zipcar Statistics:

- Zipcar members consume approximately 220 less gallons of gasoline per year than when they owned their own vehicle. An estimated 16 million gallons of gasoline has been saved between Zipcar’s 300,000 members and 6,000 cars.
- Zipcar works hand in hand with public transport often locating Zipcars close to mass transit stations. Among members, there is a 47% increase public transportation use.
- Customers are more likely to coordinate their efforts while driving a Zipcar to make more efficient trips, thus resulting in less driving.
- Members who give up their cars save an average of \$600 a month. Zipcar estimates that ninety-five percent of people living in the 13 largest cities don’t need to own cars. If just five percent of those people sign up, there will be 1 million members.
- The company estimates that for every Zipcar introduced into an area, 15-20 cars are taken off the road, which reduces the use of land and financial resources used to provide parking infrastructure.



### FastFleet

In addition to programs for personal use, Zipcar has just launched “FastFleet” which is a new service that enables government and other fleet managers to save money, reduce risk and promote sustainability. With FastFleet, for the first time, fleet operators may leverage the same technology that powers Zipcar’s consumer fleet. Washington, DC, which is the first city to adopt the system, estimates it has saved more than \$300,000 during a four month pilot of FastFleet. As expansion plans are underway, the District of Columbia estimates it will save more than \$1 million in the first 12 months.

There are approximately 4 million vehicles currently deployed across thousands of fleets within local, state and federal governments. Typically, fleets are sized to meet peak demand, which means on a daily basis thousands of fleet cars and trucks sit idle. FastFleet allows fleet administrators to have a highly efficient shared fleet of vehicles with no reduction in availability for drivers.

“Sharing a fleet of small, new, fuel-efficient cars helps keep pollutants out of our air and water”, said George S. Hawkins, Director of the District Department of the Environment.

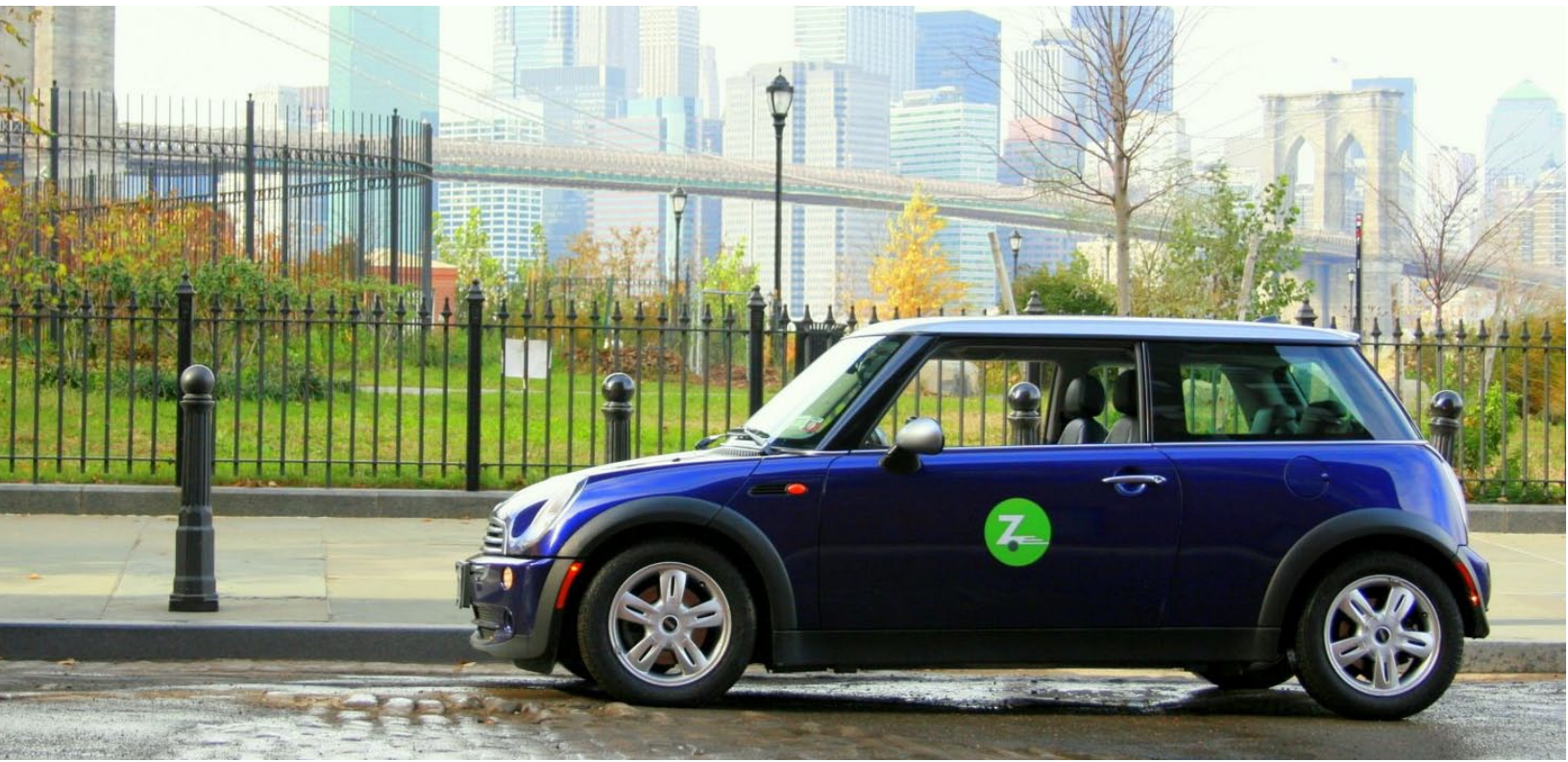
Unlike the traditional Zipcar business model, FastFleet does not supply the vehicles. Instead, client fleet administrators determine the numbers, types and locations of vehicles, which are then equipped with FastFleet's in-vehicle technology, wirelessly linking them to a dedicated FastFleet server. While FastFleet makes reserving and driving a vehicle a snap for employees, the benefits to fleet managers are even more significant. Fast Fleet's administration console enables unprecedented visibility and control over the vehicles in the fleet.

Fast Fleet allows administrators to:

- Design and configure their fleet footprint in real time for optimal utilization.
- Locate and track vehicles through a global positioning system.
- Manage hundreds of critical activities including preventive maintenance, fueling, and billing.

Interview with Ellice Perez, General Manager, Washington, DC Zipcar on May 7th, 2009  
– Zipcar May 7, 2009

*Photos courtesy of Zipcar.*





“Sharing a fleet of small, new, fuel-efficient cars helps keep pollutants out of our air and water”

*George S. Hawkins,*

*Director of the District Department of the Environment*





# tools and strategies

## **International Tools and Strategies**

How are International Governments Responding to the Sustainable Challenge?

## **Tools**

Introduction

The Idea Tool

Existing Sustainability Tools

## **Glossary**

# international tools and strategies

## How are International Governments Responding to the Sustainable Challenge?

Governments around the World are responding to the challenges of sustainability through their own policies and rating systems.

While many responses are comprehensive, they generally do not consistently address the principles of sustainability:

1. Sustainable Scale,
2. Just Distribution,
3. Efficient Allocation.

Nor do they all provide for continued, balanced measurements and comparability with a level of scrutiny for all products, systems and buildings, both new and old that will promote continuous improvement.

The following is a representative sample of international efforts to respond to the global sustainability challenge.

“... over the past 35 years alone the Earth’s wildlife populations have declined by a third. Yet our demands continue to escalate, driven by the relentless growth in human population and in individual consumption. Our global footprint now exceeds the world’s capacity to regenerate by about 30 per cent. If our demands on the planet continue at the same rate, by the mid-2030s we will need the equivalent of two planets to maintain our lifestyles.”

*James P. Leape, Director-General, WWF International*

## Japan

To address current sustainability issues, Japan is looking to the past for answers. The Edo Period (1603 to 1868) has become a model of sustainability for Japan. In a time of mandated isolationism, the people of the Edo period relied upon a closed-loop system where reuse and recycling practices nourished their survival. Today, Japan is mirroring Edo practices through recycling efforts and a focus on end-of-life products and materials that will reduce waste and prevent dioxins and other toxics from entering incinerators.

Japan is also taking advantage of new rating systems such as ECOLEAF and CASBEE. ECOLEAF, an eco-label that reflects a life cycle assessment (LCA) of a product, internationally signifies that the manufacturer has carried out an LCA report with the findings sent to the ECO-LEAF corporation. The Eco-leaf site publishes Product Category Rules (PCR) for 53 categories. PCRs function as criteria for LCA calculations for each product category, originally developed by a PCR working group following to the "Requirements for the EcoLeaf PCR", then reviewed/authorized by the PCR committee. The PCR works as the cornerstone of EcoLeaf. All of the PCRs are available to view at [http://www.jemai.or.jp/english/ecoleaf/pub\\_psc.cfm](http://www.jemai.or.jp/english/ecoleaf/pub_psc.cfm)).

CASBEE is Japan's green building rating system. It is based upon the quality of the building divided by its load impact upon the environment. It was developed in adherence to the following policies:

- The system should be structured to award high assessments to superior buildings, thereby enhancing incentives to designers and others.
- The assessment system should be as simple as possible.
- The system should be applicable to buildings in a wide range of applications.
- The system should take into consideration issues and problems peculiar to Japan and Asia.





CASBEE differs from the USGBC's LEED certification process in that LEED certification starts at the beginning of the design process, with review and comments taking place throughout the design and construction of a project. A CASBEE ranking is dependent upon pre-design tools and site visits after the building is completed.

CASBEE exhibits Japan's growing interest in green building and works with Japan's recently adopted Energy Saving Act, a mandate for effective use of energy and other resources in transportation and related activities.

Lastly, to promote and expand the use of LCA technology in order to meet its climate and sustainability challenges, Japan is implementing JEMAI-LCA Pro, an LCA software developed by the Research Center for Life Cycle Assessment, National Institute of Advanced Industrial Science and Technology (AIST) and Japan Environmental Management Association for Industry (JEMAI).

The JEMAI-LCA series collects data on specific products from industrial companies and other organizations to calculate the environmental burden at each stage of their life cycle, and to advance the calculation method for the environmental impact of products and related systems. The data obtained through this project is added to an LCA Database which is intended to educate people on eco-products and services available.

In 1999, eight domestic program body organizations from eight countries formed the Global Environment Product Declarations Network (GEDnet), which is working to broaden the use of type III environmental labels. Efforts are underway to create international standards for these type III environmental declarations.

Currently representatives from Japan, Germany, Norway, Denmark, Republic of South Korea, China, Taiwan, Australia and Sweden are participating within GEDnet. <http://www.gednet.org/>



## The United Kingdom

In 2006, the Prince of Wales' Accounting for Sustainability Project released the *Connected Reporting Framework*, a sustainability reporting tool for corporations and government agencies. The Framework made use of existing financial and non-financial information and satisfied what had been a lengthy gap in comprehensive sustainability tools.

The *Framework* is a tool and guideline that helps to embed sustainability into a corporation's daily operations by helping them to "understand the issues, set overall direction, make a plan, and understand what [they] are doing" within four priority areas:

- scale,
- sustainable consumption,
- environmental performance, and
- competition.

Rather than a one-size-fits-all approach, the framework is a sustainability decision-making model, a step-by-step guide to ensure that reporting is comprehensive yet understandable and useful. (see <http://www.sustainabilityatwork.org.uk/strategy/report/0>).

The *Connected Reporting Framework* guides organizations to meet key principles of reporting quality: balance, comparability, accuracy, timeliness, clarity, and reliability.

Partners in the project included the Sustainable Development Commission, National Audit Office (NAO), and the Department for Environmental Food and Rural Affairs (Defra).

## Australia

Australia is the driest inhabited continent on earth. As the impacts of climate change intensify, Australia faces increasingly acute and long-term water shortages in its cities and regional areas – lower rainfall, rivers drying and dam water levels falling. Tackling the existing water crisis is a long-term priority for the Australian Government.

The National Water Initiative (NWI) is Australia's blueprint for water reform. Through it, governments across Australia have agreed on actions to achieve a more cohesive national approach to the way Australia manages, measures, plans for, prices, and trades water.

The Intergovernmental Agreement on a National Water Initiative was signed at the 25 June 2004 Council of Australian Governments meeting. Under the NWI, governments have made commitments to:

- prepare water plans with provision for the environment
- deal with over-allocated or stressed water systems
- introduce registers of water rights and standards for water accounting
- expand the trade in water
- improve pricing for water storage and delivery
- meet and manage urban water demands.

The NWI plans to achieve a national, regulatory and planning based system for managing surface and groundwater resources that optimizes economic, social and environmental outcomes. (<http://www.nwc.gov.au/www/html/117-national-water-initiative.asp?intSiteID=1>)

Currently, certain products are registered and labeled with their efficiencies, in accordance with the standard set under the national Water Efficiency Labelling and Standards Act 2005 (WELS); similar to the energy rating label (which clothes washing machines and dishwashers must carry). This allows consumers to compare products and rewards manufacturers and retailers who make and stock water efficient models.

The label displays a zero to six star rating for a quick comparative assessment of the product's water efficiency. The more stars, the more efficient the product. It is expected that by 2021, Australians could save more than \$600 million through reduced water and energy bills and help to:

- reduce domestic water use by 87,200 megalitres (23,035,802,966 gallons) each year (5%); and
- save a total of 610,000 megalitres (161,144,951,940 gallons) of water

Nearly half the water savings are expected to come from more efficient washing machines, 25% from showers, and 22% from toilets.

### *Other Australian Government initiatives*

- Energy Efficiency in Government Operations (EEGO)
- Assisting Government agencies to develop and introduce environmental management systems
- Environmental purchasing
- Encouraging the consideration of relevant environmental policies, programs, costs and benefits in Australian Government purchasing by the provision of voluntary environmental purchasing tools.
- Water efficiency guide: office and public buildings The Australian Government, with the governments of Queensland, New South Wales, the Australian Capital Territory, Victoria, South Australia and Western Australia, has developed a new guide for improving the water efficiency of office buildings and public buildings. This guide contains case studies from water efficient buildings, and provides practical guidance on how to reduce water use and water wastage. The guide covers both technical and behavioral opportunities.
  - » The state of New South Wales (NSW) offers a Green Business Program is providing \$30 million throughout five years for projects that will save water and energy in business operations locally.
  - » South Australia Water's Business Water Saver Program works to identify opportunities to reduce water consumption and minimize wastewater production.
- National Water Intensity Benchmarks: the governments of Queensland, New South Wales, the Australian Capital Territory, Victoria, South Australia and Western Australia, are developing water intensity benchmarks for office buildings and public buildings. Water intensity refers to the water consumed per square meter of space. The benchmarks provide guidance to building owners, managers and tenants on how their buildings measure up against similar sites nationwide.



*"South San Francisco Bay, California." Photo Credit: Jonathan Herz*

## Canada

In 1995, the *Guide to Green Government* reinforced Canada's commitment to sustainability. It laid a foundation for departments to prepare a comprehensive framework.

Sustainable development has long been a part of Canada's governmental policies and laws. Federal departments and agencies are legally required to table or report on a Sustainable Development Strategy (SDS) in Parliament every three years. As a result, Canada has benefited from continually evolving, new, and more accountable approaches for sustainable development strategies.

The most recent, SDS strategy, created an opportunity to establish government-wide priorities, accountabilities, targets, timelines and reporting requirements that include:

- Reductions in energy resources consumption
- Reduction in greenhouse gas and other air polluting emissions
- Green procurement
- Remediation of contaminated sites
- Waste management
- Environmental performance of vehicle fleet

Sustainable development "...is a continually revolving concept based on the integration of social, economic and environmental concerns, and which may be achieved by, among other things,

a) the integration of the environment and the economy; b) protecting the health of Canadians; c) protecting ecosystems; d) meeting international obligations; e) promoting equity; f) an integrated approach to planning and making decisions that takes into account the environmental and natural resource costs of different economic options and the economic costs of different environmental and natural resource options; g) preventing pollution; and h) respect for nature and the needs of future generations."

*Canadian Auditor General Act (amended in 1995)*

The Office of the Commissioner of the Environment and Sustainable Development has also reported and continues to report every year on the Government's performance regarding environment and sustainable development matters, with a particular focus each year on progress and challenges (reports of the CESD can be found at [www.oag-bvg.gc.ca](http://www.oag-bvg.gc.ca)).

Additional involvement includes international conventions/protocols/agreements, the Federal Sustainable Development Act, and the Sustainable Development Strategies Management Review.

### *Other Initiatives: Enviroclubs*

The Enviroclub initiative was developed by three federal government agencies (Canada Economic Development for Quebec Regions, Environment Canada and the National Research Council Canada) to bring together organizations from similar regions or sectors to carry-out pollution prevention projects. The projects generate cost savings while reducing emissions, energy, and raw material consumption.

Between 2000 and 2004, ten Enviroclubs were established and saw immediate results. From 2000 to 2005, 14 Enviroclubs from the Quebec region alone enabled 168 enterprises collectively to make recurring savings of \$10.5 million a year while reducing on a yearly basis their consumption of:

- petroleum products, representing more than 4,000 barrels of oil
- propane, sufficient to fill 85,500 barbecue gas cylinders
- natural gas, sufficient to heat 1,350 mid-sized houses
- water, representing consumption by 8,000 people
- wood, equivalent to 6,210 cords
- and their discharge of:
  - greenhouse gases, equivalent to the emissions from 6,217 cars
  - hazardous waste, enough to fill 58 garbage trucks
  - some 500 tonnes of chemicals, many of them toxic.

*(Canada Economic Development for Quebec Regions, SDS 2007-2010 principles, targets and approaches, <http://www.dec-ced.gc.ca/eng/publications/agency/dev/59/page-4.html>).*





## India

India's traditional architectural foundation generally reflects sustainable design principles. But more popular and modern demand shifted design and construction towards an unsustainable Western style such as poorly performing glass boxes.

Such structures are particularly unsustainable because India's booming population and growing economy coupled with expected climate impacts will place some of the world's most intense stresses upon its local environment and natural resources. A booming resource demand will only intensify this resource strain. Thus, creating sustainable Indian buildings is crucial for progress.

New voluntary rating systems and enhanced building codes are beginning to transform the built environment.

In 2001, India launched its own LEED rating system, through the India Green Building Council (IGBC). The Leadership in Energy and Environmental Design (LEED-INDIA) Green Building Rating System is a nationally and internationally accepted benchmark for the design, construction and operation of high performance green buildings. LEED-INDIA provides building owners, architects, consultants, developers, facility managers and project managers the tools they need to design, construct and operate green buildings specific to India's climate culture in the following areas:

### Sustainable site development

- Water savings
- Energy efficiency
- Materials selection and
- Indoor environmental quality

The programs include LEED India for New Construction (LEED India NC), LEED India for Core and Shell (LEED India CS), the IGBC Green Homes Rating System, and IGBC Green Factories. In addition, other rating programs including such as the BEE Star and the Green Rating for Integrated Habitat Assessment (GRIHA) encourages energy efficiency and the minimized use of air conditioning except under extreme cases. (*"Greening India", GreenSource, May/June 2009.*)



*"Lavasa Hill Station Master Plan Design. Warasgaon Dam, India." Photo courtesy of HOK.*

# tools

## Introduction

There aren't many things more frustrating than attempting to make a decision about a "green" product, material, or service from amongst the multiple market choices:

- Should I buy the energy consuming, regional product or the energy-efficient, international product?
- This product helps to achieve LEED® points but does it contain toxics?
- Should I specify the non-renewable, local product or the renewable bamboo from China?

So what do we really need to know about products and services? And how do we ensure that the choices we make are sustainable?

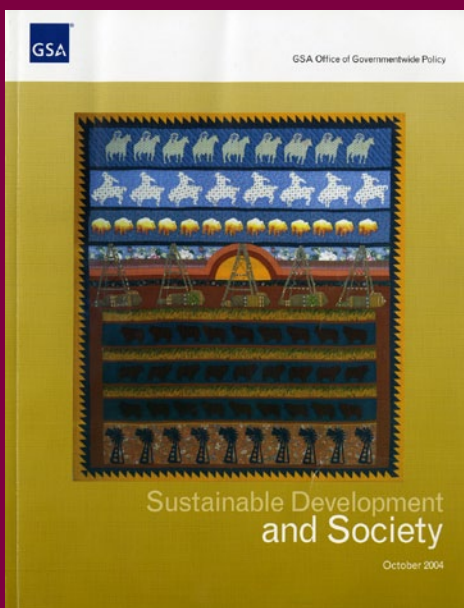
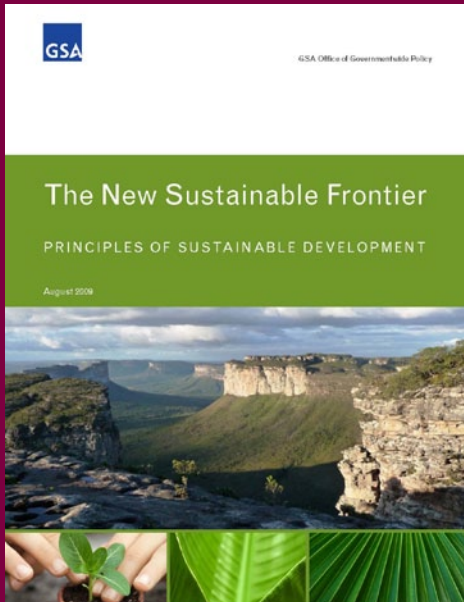
Existing U.S. Environmental Protection Agency (EPA) programs work to eliminate toxics, promote recycling, and identify life-cycle cost effective goods, services, and building practices that protect human health and the environment. With the U.S. Department of Energy (DOE), the EPA identifies energy efficient products, technologies and systems that reduce energy consumption and greenhouse gas generation.

The Department of Labor promotes economic well-being and just distribution through oversight of wage and working conditions, and the Small Business Administration helps promote advancement of small and historically disadvantaged businesses.

While these and many other programs support progress towards the goal of sustainable Government operations, existing economic decision-making models can sometimes undermine that progress. With careful and appropriate modifications, these models can help lead to sustainable solutions.

New tools, such as backcasting and multi-criteria analysis can identify sustainability goals and the strategies needed to achieve them. If the Government is to operate sustainably, existing policies and economic decision-making models need to be changed to reflect the realities of a closed world.

As a rule, a necessary but complex component in operating sustainably is the capacity to calculate the impacts of complex





production processes involved in the everyday operations and use of materials. Although the process can be resource, time, and labor-intensive, life cycle assessments are useful for this. Current sustainability tools generally try to incorporate lifecycle cost and lifecycle assessment thinking and fill in the information gaps that can lead us to the unsustainable options. They provide a method to measure the amount of energy and raw materials consumed at each stage of a building and product's life.

However, life-cycle assessments should not be viewed as the silver bullets toward sustainability. While they are helpful in analyzing a theoretical, environmental footprint, LCA's alone are not enough. A new perspective is needed where products and materials are measured in terms of throughput - to minimize the use of natural resources and reduce waste.

## The Ideal Tool

An ideal sustainability tool needs to help us understand operational choices in the context of scale, distribution, and allocation. It would:

- Perform a life cycle analysis that accounts for human health and acknowledge the limitations of current knowledge and practices.
- Be comprehensive and comparable.
- Account for energy balance and resource flows from a product.
- Apply backcasting to monitor whether or not the tool is helping to meet goals.

The goal of an ideal sustainability tool would be to rate products, buildings, and services on their ability transform open, throughput-oriented systems into closed-loop systems. In the end, raw materials would be recycled and wastes eliminated. *To achieve this, the ideal tool would need to integrate multiple components: life-cycle assessments, multi-criteria analysis, new sustainable indexes, and backcasting.*



## New Tools and Strategies: Backcasting and Multi Criteria Analysis are Tools that Can Identify Sustainable Goals and Strategies.

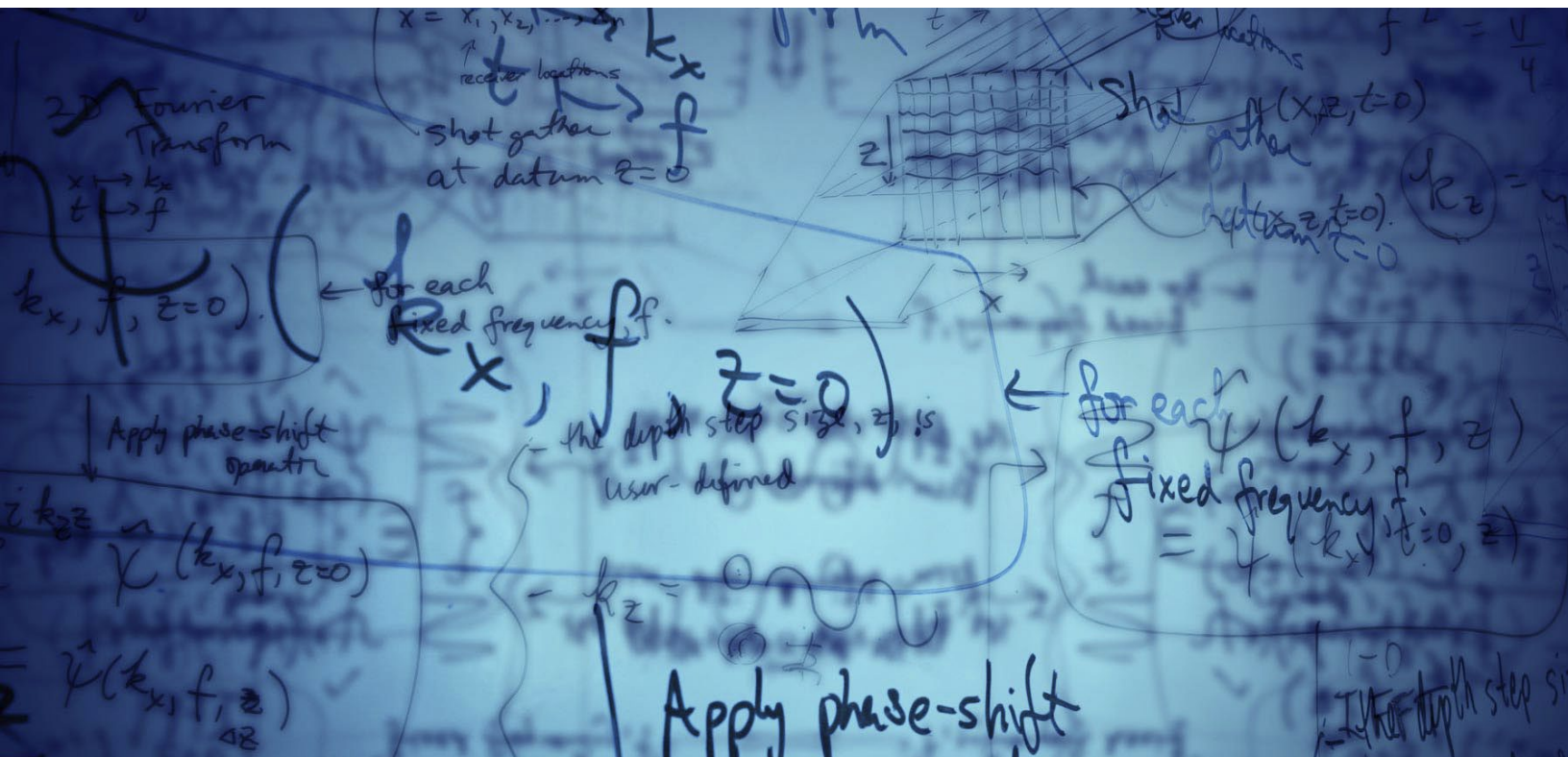
There are economic, environmental, and social consequences to every business decision we make. These decisions affect the resources that are available to those living today and to future generations—our children, our grand children, and generations far into the future. Economic policy-making, planning and tools must reflect this reality.

Earlier, we asked how we could operationalize sustainable concepts and integrate them into the way we deliver buildings, products and services. In this section, we will try to answer some of these questions.

### *Cost-Benefit Analysis and Life Cycle Assessment*

Cost-Benefit Analysis (CBA) and Life Cycle Assessment (LCA) are two of the most useful tools we have to help us make investment decisions. The logic of seeking greater benefits than costs is indisputable. And, properly applied, LCAs transform open, throughput-oriented systems into closed-loop systems for products, services and buildings.

But, their use must be consistent with the economics of sustainability. We need to open the “Black Box” of CBA and LCA to examine their assumptions, and change the way we apply them to our decision-making process.



## Multi Criteria Analysis

Many ecological economists criticize cost-benefit analysis because it relies on pricing of all factors involved in decision-making, including human lives, endangered species, and clean air and water. Multi Criteria Analysis is a decision-making framework for multi-disciplinary problems. This process includes the participation of many interested parties in decision making and in problem solving, and is focused on compromise or defining a coalition of views rather than dictation of judgment from a single stakeholder category.

Its greatest potential is in situations involving multiple value systems and objectives, which cannot be easily quantified (e.g. environmental issues) or translated in monetary terms due to their intangible nature e.g. social, cultural or psychological issues. This process involves stakeholders directly by presenting them with alternatives and allowing them to rank them. This brings a wide range of views and knowledge into decision-making.

Multi Criteria Analysis expands upon cost-benefit analysis, uses qualitative as well as quantitative measuring scales, is used to resolve problems with multiple values systems and objectives, and Involves stakeholders directly in decision-making.

## Sustainable Indexes

It is essential for a government of a country or a state to be able to measure if it is doing a good job; moving in the right direction. The most commonly used indicator is the Gross Domestic Product (GDP). While GDP is a measure of economic activity (the amount of goods and services produced / consumed) which is sometimes used as a proxy for welfare. In theory, that means if GDP goes up, welfare will also go up, since people buying goods and services must mean that they value them higher than the price they pay, thereby generating additional welfare / satisfaction to them.

However, GDP does not include many components of welfare, including capital depreciation, goods and services purchased to counter externalities, household labor, volunteerism, and crime. Paradoxically, using cost benefit analysis, pollution can contribute to the calculation of economic welfare while the cost of prevention and amelioration can sometimes appear to reduce economic activity, and implicitly, public welfare.

A forest's ecosystem may contribute to economic and social well-being through provision of clean air, wildlife habitat, and recreation opportunities. But, GDP only includes the value of timber harvested from the forest and any "user fees" that may be leveraged from visitors.

There are measurement systems that reflect these factors and measure progress that includes both sustainability and well-being. Alternative indicators differentiate between the costs and benefits of growth and facilitate policies and institutional changes that promote activities where the needs of both the economy and environment can be met and create incentives for conservation and sustainable management of resources.

The Index of Sustainable Economic Welfare (ISEW) (Redefining Progress, 1995) recognizes that there are factors other than consumption that contribute to or detract from welfare. Some of the factors

are relatively easy to measure, such as capital formation, but others pose problems. For example, the depreciation of natural capital requires putting a value on it, which is highly debatable.

ISEW values durable goods based on service, not consumption. It subtracts the cost of air, water, and noise pollution, loss of wetlands and farmland, depletion of nonrenewable resources, and long-term environmental damage

The Genuine Progress Indicator (GPI) (Daly & Cobb 1989), which is very similar to ISEW, has recently come into favor. The Maryland Department of Natural Resources is using the Genuine Progress Indicator in accounting for their use of natural capital. This project originated out of concern for the economic impacts associated with water use on public lands. The State feels a responsibility to use this public water in a way that provides the most long-term benefit to Maryland's citizens, including social and environmental effects as well as impacts on economic performance.

The importance of indicators like ISEW and GPI is that using the Gross Domestic Product alone can lead to erroneous conclusions and counter productive policies. While both GDP and ISEW in the U.S. rose during 1960s, GDP continued to grow fivefold through the 1980's while the ISEW fell slightly in 1970s and sharply in 1980s – reflecting growing income inequality and exhaustion of resources.

“If an activity is sustainable, for all practical purposes it can continue forever. When people define an activity as sustainable, however, it is on the basis of what they know at the time. There can be no long-term guarantee of sustainability, because many factors remain unknown or unpredictable. The moral we draw from this is: be conservative in actions that could affect the environment, study the effects of such actions carefully, and learn from your mistakes quickly.”

“‘Sustainable growth’” is a contradiction in terms: nothing physical can grow indefinitely.”

“‘Sustainable use’” is applicable only to renewable resources: it means using them at rates within their capacity for renewal.”

“‘Sustainable development’” is used in this Strategy to mean: improving the quality of human life while living within the carrying capacity of supporting ecosystems.”

*International Union for Conservation of Nature and Natural Resources/  
United Nations Environment Programme/World Wide Fund for Nature, 1991*

## Backcasting

How do we make sure that our policies are taking us where we want to go? If we are trying to create a sustainable world, it helps to look at the desired goal and develop strategies directly connected to that goal. This approach is known as 'Backcasting,' which can best be defined in contrast to forecasting.

Forecasting is based on observation of past trends, which are then extrapolated to identify the most likely future developments. While forecasting seems like a logical way to reach a desired goal, it uses deterministic pathways and bases future actions on past practices that may actually have contributed to the problem at hand. This approach can be called "path-dependent."

Backcasting approaches the issue of path-dependency and desirability of long-term outcomes from the opposite perspective.

First, a desirable long-term sustainability target is defined. Then, a backcasting methodology is used to analyze the status quo to identify pathways leading to problem solving.

The backcasting process compares the desired target - such as diminishing the effects of global warming - and the status quo. In this case, establishing a goal of 350 parts per million of carbon dioxide in the atmosphere can lead to specific, necessary steps linking the present to the desired future. With this approach, well-meaning, but possibly ineffective policies can be avoided. Such an approach can determine whether reducing building energy cost budgets by 20 or 30 percent will be sufficient. Some estimates require an 80 percent decrease in world global warming pollution by 2050 to prevent the worst consequences of global warming.

In a multi-disciplinary organizational environment, backcasting will result in tangible milestones along a timeline, leading towards the long-term target. It provides a framework for establishing the policies and developing the tools that will ultimately operationalize sustainable development.

Unlike the random time periods associated with life cycle cost payback formulas, backcasting uses appropriate-length time spans to create methodological advantages. This approach is now increasingly applied in organizations, corporations, municipalities, agencies etc., to ensure reaching desirable strategic goals within a realistic and achievable time horizon.



*"Apollo 17, Earth." Photo Credit: NASA*

## Existing Sustainability Tools

### *Existing Tools And Strategies*

Several existing sustainability tools and strategies are in place that, if fully implemented, would significantly reduce the Government's impact on the natural environment and promote economic prosperity and social equity. There is no reason these policies cannot be fully implemented now in the acquisition of all goods and services that support Government operations.

With the exception of The National Oceanic and Atmospheric Administration's (NOAA) "Habitat Priority Planner," which begins to address these ideas, no readily available existing tools and strategies comprehensively address the principles of sustainability:

1. Sustainable Scale
2. Just Distribution, and,
3. Efficient Allocation.

Nor do they all provide for continued, balanced measurements and comparability with a level of scrutiny for all products, systems and buildings, both new and old, which will promote continuous improvement. Where economic principles are applied, they are base on traditional ideas of the open (rather than closed) world of perpetual growth.

The following is a first attempt to put existing tools and strategies into the truly sustainable context.

### *'Ready to Go' Tools*

The Environmental Protection Agency, particularly the Office of Pollution Prevention, has programs to identify products and practices that reduce or eliminate waste and toxic substances in Government operations and promote recycling of materials. Agencies should work with EPA to eliminate use of non-compliant products and services. The EPA and the Department of Energy's Federal Energy Management Program (FEMP) also have programs that reduce energy consumption in products, services and buildings. ENERGY STAR qualified and FEMP designated products may be assumed to be life cycle cost-effective.

The benefits of these programs are easily demonstrated. And, depending upon the speed and breadth of their implementation, will reduce resource consumption and prevent pollution, and will move us towards sustainability.



### *Tools Needing Further Consideration*

Some of the other tools used by the Government address more complex matters, and are themselves far more complex. While the elements that make up these tools are generally “transparent,” they function as a sort of “Black Box,” allowing their use without requiring detailed knowledge of their internal workings. These tools need further consideration:

- Office of Management and Budget OMB Circular A-11, “Preparation, Submission, And Execution of the Budget,” which includes principles for capital asset acquisitions which address planning, costs and benefits, financing, and risk management requirements
- Various life cycle cost analysis (LCCA) guidelines, including:
- OMB Circular A-94, “Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs,”
- FEMP life-cycle costing rules and procedures; NIST Handbook 135, “Life-Cycle Costing for the Federal Energy Management Program;” and
- Tri-Services Memorandum of Agreement on “Criteria/Standards for Economic Analyses/Life-Cycle Costing for MILCON Design”
- The National Institute of Standards and Technology’s BEES® (Building for Environmental and Economic Sustainability) tool contains data on life cycle inventory results for a variety of building materials and building components
- Green Building Rating Systems, particularly the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) rating system

How do we know whether these guidelines and tools result in sustainable choices, in the sense that they can be “carried on for a prolonged duration, or for the foreseeable future?”

Are these tools taking us where we want to go or are there unintended consequences? Some of them, like traditional lifecycle costing, have been the basis of economic decision-making for decades. But the state of the environment gives testament to the fact that these results are not sustainable.

# Envisioning a Sustainable and Desirable America

*Robert Costanza*

## World View

Humans as a part of nature  
Steady state, ecological economy  
Goal quality of life rather than consumption

## Natural Capital

Protected as essential life support  
Depletion heavily taxed

## Built Capital

Runs on renewable energy and natural capital  
Emphasis on quality rather than quantity  
Small communities rule (both within and outside cities)

## Human Capital

Balance of synthesis, analysis, and communication  
Meaningful, creative work and leisure  
Stable populations

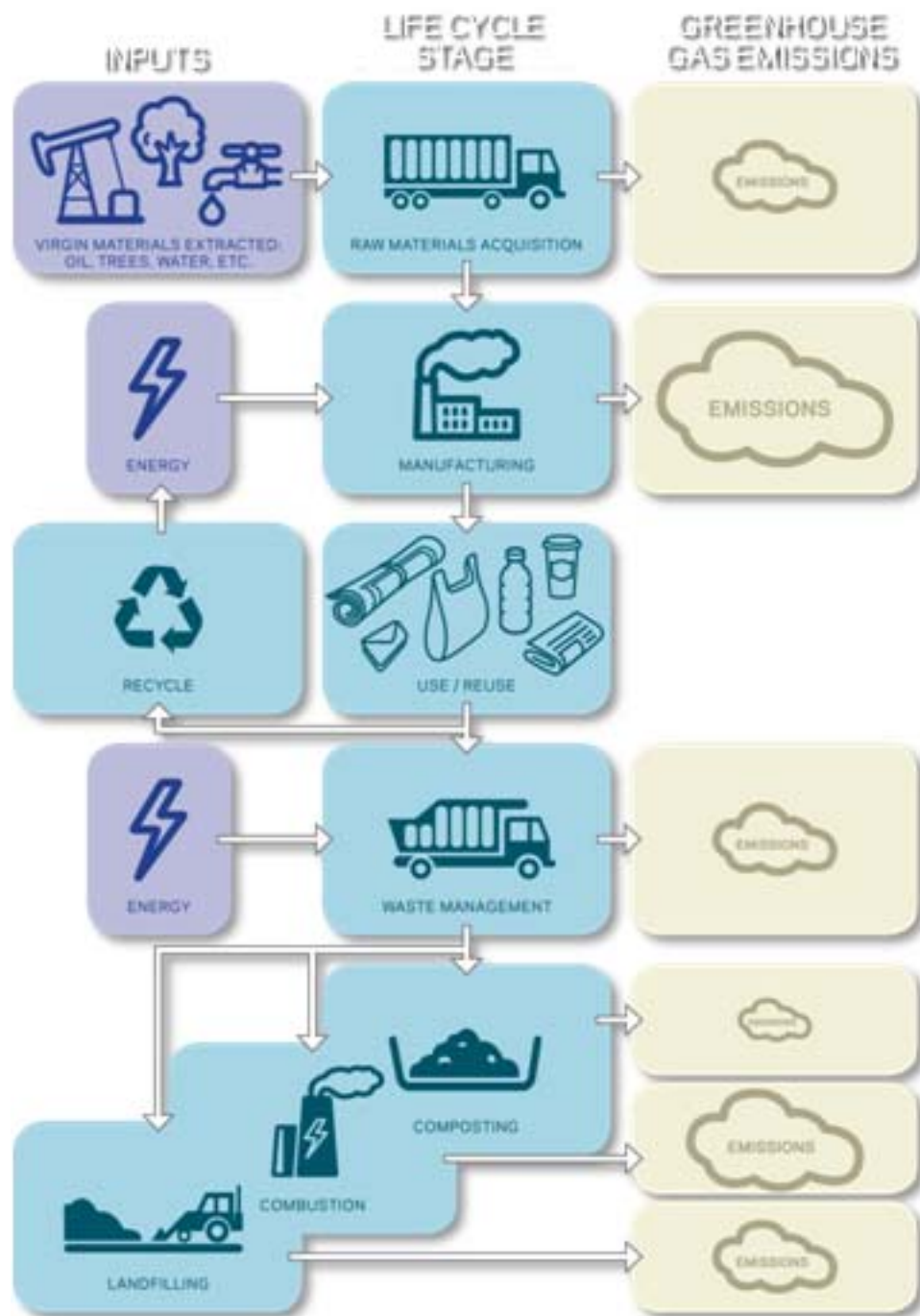
## Social Capital

A primary source of productivity and well-being  
"Strong" democracy

see <http://www.uvm.edu/giee/beyondenvironmentalism/costanza.htm>



# PHASES OF A PRODUCT'S LIFE-CYCLE



PRODUCT'S LIFE-CYCLE



## Life-Cycle Assessments for Products

### *Building for Environmental and Economic Sustainability (BEES)*

BEES measures environmental performance of building products using life-cycle assessments (LCA) specified in the ISO 14040 series of standards. BEES is for designers, builders, and product manufacturers and includes actual environmental and economic performance data for nearly 200 building products. Users do not need to know the intricacies of conducting LCA studies and little time is required to evaluate the material or product of interest. Environmental impacts are optionally combined into a single environmental performance score.

Limitations: it does not allow users to enter new products; rather, it's a tool for browsing pre-stored LCA and life-cycle costing (LCC) information on building components and materials. The subjectivity involved requires placing scores into the user's perspective and the BEES overall performance scores do not represent absolute performance. Instead, they represent relative performance among the alternatives.

Database Indicators: BEES 3.0 contains environmental and economic performance data for nearly 200 products across 23 building elements including beams, columns, roof sheathing, exterior wall finishes, wall insulation, framing, roof coverings, partitions, ceiling finishes, interior wall finishes, floor coverings, chairs, and parking lot paving.

BEES 4.0 was published in May 2007. The new release offers improved data. A total of 230 products are available for analysis and comparison (up from 198 in version 3.0), including 117 generic products and 163 brand-specific products, of which 23 are anonymous. (<http://www.buildinggreen.com/auth/article.cfm/2007/6/7/BEES-4-0-LCA-Software-Continues-Evolution/>)

Applicability to GSA operations: BEES can be used to compare the LCC and LCA of alternative building material choices. Congress provided fund to the USDA to support testing for biobased content using for products within the USDA that have been selected to designate for preferred procurement. As a result, manufacturers use NIST's BEES analytical tool to provide information on life-cycle costs and environmental and health benefits to federal agencies, when asked. USDA recommends that federal agencies affirmatively seek this information.

'Are our tools taking us where we want to go or are there unintended consequences? Some of them, like traditional lifecycle costing, have been the basis of economic decision-making for decades. But the state of the environment gives testament to the fact that the results are not sustainable.'

How does BEES compare against sustainability principles?

**1. Sustainable Scale:**

a. *Does it address if the product returns to a reusable or biodegradable state?*

BEES indirectly addresses recycling potential and whether or not commercial or industrial products are composed of biological products or renewable domestic agricultural materials. Such products are for the most part, recyclable or compostable and break down in landfills once the product wears out. BEES does not address incentives or processes for take-backs.

b. *Does it address whether or not the company is going to lessen the environmental impact of the product?*

Global Warming, Acidification, Eutrophication, Fossil Fuel Depletion, Indoor Air Quality, Habitat Alteration, Water Intake, Criteria Air Pollutants, Smog, Ecological Toxicity, Ozone Depletion, and Human Health are addressed.

c. *Does it address whether or not environmental accountability is required of the suppliers?*

Yes; to qualify for the new “USDA Certified Bio-based Product” label, products must first develop a BEES profile.

**2. Toxics:**

a. Does it address toxics? Yes; ecological toxicity is an impact category.

**3. Just Distribution:**

a. Does it address whether or not the product manufacturer put back into the community? No

**4. Efficient Allocation:**

a. Does it address whether the product is the best solution to the problem?

Subjectively by User – products are compared and scores are based upon the user’s preferences. Continued, balanced measurements and comparability: Is the tool’s data measurable? What is the unit of comparison? Does it maintain a level of scrutiny to all products, both new and old? Yes, but subjectively by user and weighted by the environmental impact categories. You must ensure a baseline weighting in order to accurately assess between multiple products.





### *McDonough Braungart Design Protocol (MBDC)™*

MBDC uses the Cradle-to-Cradle Design Protocol, a scientifically based, peer-reviewed process to assess and optimize materials and their production processes. The Protocol, developed by Michael Braungart and his colleagues at Environmental Protection Encouragement Agency (EPEA) in Germany, places products into one of four categories based on human health and environmental relevance criteria. After all chemicals are assessed, the materials in a product application are optimized by positively selecting replacements for chemicals characterized as 'red'. These chemicals include all known or suspected carcinogens, endocrine disruptors, mutagens, reproductive toxins, and teratogens) and using 'green' chemicals as they are available.

Any product can be evaluated based upon its chemical hazard, recyclability and recycled content, energy and water use. Products that meet MBDC criteria may be certified as a Basic, Silver, Gold or Platinum product or as a Technical or Biological Nutrient, and can be labeled as Cradle-to-Cradle.



### ***According to PHAROS, an LCA tool to evaluate specific building materials and systems:***

MBDC's basic and silver certifications are primarily based on doing inventories of energy and water flows, inventories of contents and making commitments to work with MBDC on eventual phase out of red list chemicals and improvement of water and energy flows. There can be no polyvinyl chloride (PVC) and background contamination of lead, mercury, cadmium and chrome are limited, but can be added for technical performance needs. For Silver, some of the product must be either recycled content or recyclable. Basic corporate policy statements on fair labor and other social ethics practices are required for Silver. Gold and platinum require increasing amounts of actual demonstrated changes in products and operations.

How does MBDC compare against sustainability principles?

#### **1. Sustainable Scale:**

- a. Does it address if the product returns to a reusable or biodegradable state? Yes
- b. Does it address whether or not the company is going to lessen the environmental impact of the product? Yes
- c. Does it address what happens when the product wears out? Or whether or not there is a process or incentive for take backs or recycling? Yes

d. Ecology: Does address whether or not environmental accountability is required of the suppliers (federal policy to mandate)? No

e. Does it address Toxics? Yes

## 2. Just Distribution:

a. Does it address whether or not the product manufacturer put back into the community? Yes

## 3. Efficient Allocation:

a. Economy: Does it address whether the product is the best solution to the problem? Yes

## 4. Toxics:

a. Is there continued, balanced measurements and comparability? Is the tool's data measurable? What is the unit of comparison? Does it maintain a level of scrutiny to all products, both new and old? Yes

## LCA within Green Building Standards and Third-Party Verification

Systems: Building standards and verification systems are good programs if the user understands their Green Building Standards and Third-Party Verification Systems.

### LEED®

LEED is an internationally recognized green building certification system, providing third-party verification that a building or community was designed and built using strategies aimed at improving performance across: energy savings, water efficiency, CO<sub>2</sub> emissions reduction, improved indoor environmental quality, and stewardship of resources.

There is little argument over the level of influence that the USGBC's LEED rating system has had upon the built environment, manufacturing sector, and community conscience. Through its market transformation, LEED has created a new worldwide level of environmental awareness and sustainability.

For instance, we may know that water was saved and greenhouse gases avoided. But how do we know if LEED buildings are truly making the Earth sustainable? If sustainable development involves transforming the current "green" baseline beyond best practices, a design team should focus on issues such as waste elimination, renewable energy, closed loop flows, reduced transportation demand, energy efficiency and their ecological, social, and moral weightings.

How does LEED compare against sustainability principles?

LEED addresses multiple environmental and social attributes through various phases; however, there is no way to know whether LEED is sustainable since it is not placed in any type of context (e.g. through backcasting). Performance audits are not required post certification thereby creating an untested and limitless grade for all rating systems with the exception of 'Existing Buildings'.



**1. Sustainable Scale:**

- a. Does it address whether or not the user needs a new building?  
No. LEED it typically brought in after the decision to build has already been made.
- b. Does it provide a life-cycle plan from design through construction to operations and management? Life-Cycle Assessment is not a criterion to achieve LEED certification. LEED 2009 –Green Building Design and Construction has integrated aspects of LCA into its regional priority credits. LCA may also be used to achieve ID credits following strict performance criteria.
- c. Does it address the context of the project? Whether or not the company is going to lessen the environmental impact? Is it on a rural Greenfield or Urban infill? What region is the building in? Yes; extensively.
- d. Does it address whether or not the building minimizes the use of non-renewable resources?  
Yes; however, the use of renewable resources are greatly encouraged but not required.

**2. Toxics:**

- a. Does it address Toxics? Yes; however, the elimination of toxics is recommended but not required (e.g. toxic pest-control, volatile and toxic compounds within materials).

**3. Just Distribution:**

- a. Does it address whether or not the building makes people flourish?  
Yes
- b. Does it address if the building is aesthetically pleasing? No.
- c. Does it address if the building meets program needs and allow the users to be productive? Does it address if the users are happy with their space? To an extent. Owners may opt to implement an occupant survey but there is not process to verify that an owner responded to occupant discomfort levels, if any.
- d. Does it address if the building negatively affect the user's health?  
Yes. Quality of life and health are addressed within credits. It encourages owners to design in ways that allows occupants to be healthy, productive, and happy. Prerequisites ensure that basic comfort and environmental quality levels are met.

**4. Efficient Allocation:** Not directly addressed

### *GREENGUARD Environmental Institute*

GREENGUARD Environmental Institute (GEI) is an industry-independent, non-profit organization that oversees the GREENGUARD Certification Program. GEI is an ANSI Authorized Standards Developer, and establishes acceptable indoor air standards for Indoor Air Quality, Schools, and Building & Construction.

Testing Procedures: The products are loaded into controlled environmental chambers which are then loaded with purified air streams that resemble airflow patterns of rooms and buildings into the chamber. GEI collects samples from the exhaust air. The environmental chamber testing provides a controlled and representative indoor environment that allows the product to produce the emissions in a realistic manner similar to the way the product would emit in a home or office.

Products are tested for formaldehyde, volatile organic chemicals (VOCs), particulates, ozone, carbon monoxide, nitrogen oxide, and carbon dioxide emissions. The environmental chamber testing emissions data can be mathematically modeled to determine exposure concentrations produced by the use of the product in many different indoor environments.

Limitations: GREENGUARD only provides a small snapshot of the product's make-up. It does not address the physical composition of a product (a typical test involves measurement of emissions over 168 hours with measurement points at 6, 24, 48, 72, 96, and 168 hours).

How does GreenGuard compare against sustainability principles?

#### **1. Sustainable Scale:**

- a. Does it address if the product returns to a reusable or biodegradable state?  
No; this program is only designed to evaluate VOCs, no other health and environmental attributes
- b. Does it address whether or not the company is going to lessen the environmental impact of the product? Yes; to the extent related to VOCs
- c. Ecology: Does it address what happens when the product wears out; or whether or not there is a process or incentive for take backs or recycling? No
- d. Ecology: Does it address whether or not environmental accountability is required of the suppliers?  
No

#### **2. Efficient Allocation:**

- a. Does it address whether the product is the best solution to the problem? No

#### **3. Just Distribution:**

- a. Does it address whether or not the product manufacturer put back into the community?  
No; this program is only designed to evaluate VOCs, no other health and environmental attributes

#### **4. Toxics:**

- a. Is there continued, balanced measurements and comparability? Is the tool's data measurable? What is the unit of comparison? Does it maintain a level of scrutiny to all products, both new and old? Yes but this program is designed to only evaluate VOCs; no other health and environmental attributes.

### *Green Seal*

Green Seal is a voluntary labeling program to certify products for compliance with VOC and other chemical content criteria for indoor air quality and smog. It is a US-based ecolabeling organization that meets the United States Environmental Protection Agency's Criteria for Third Party Certifiers, the requirements of ISO 14020 and 14024, and the standards of the Global Ecolabelling Network.

Green Seal evaluates a product from the raw materials through the manufacturing process and ending with recycling or disposal. \The Green Seal means that the product has passed the tests; that it works as well as or better than others in its class.

Products covered include:

- Paints (including recycled content latex paint) (GS-11 and GS-43)
- Commercial Adhesives (GS-36)
- Windows & Doors & Window Films (GS-13)
- Electric Chillers (GS-31)
- Compact Fluorescent Lamps (GS-05)
- Occupancy Sensors (GS-12)
- Green Seal also covers a variety of paper, newsprint, cleaning and floor care products

Testing Procedures: Manufacturers arrange for product testing and submit product test data to Green Seal. Testing must be conducted by a facility meeting the requirements of the standard for test method, documentation, and reproducibility. Manufacturers with labs meeting the criteria are allowed to test their own products. Green Seal acts as the certifying agency, evaluating the testing results, and awarding the label.

***According to PHAROS, an LCA tool to evaluate specific building materials and systems:*** "Green Seal's VOC restrictions are equal to SCAQMD, the South Coast Air Quality Management District, in some cases, less rigorous in others." SCAQMD develops, adopts and implements air standards established by national and state governmental legislation. "The one exception to that is Green Seal's restriction on point-of-sale added colorants (tints) to paints- an issue not addressed by SCAQMD, LEED or any other standard"; an important note as VOC levels often rise after colorants are added.

How does Green Seal compare against sustainable principles?

#### **1. Sustainable Scale:**

- a. Ecology: Does address whether or not environmental accountability is required of the suppliers? Yes
- b. Does it address what happens when the product wears out? Or whether or not there is a process or incentive for take backs or recycling? Yes

#### **2. Just Distribution:** not directly addressed



3. **Efficient Allocation:** not directly addressed

4. **Toxics:**

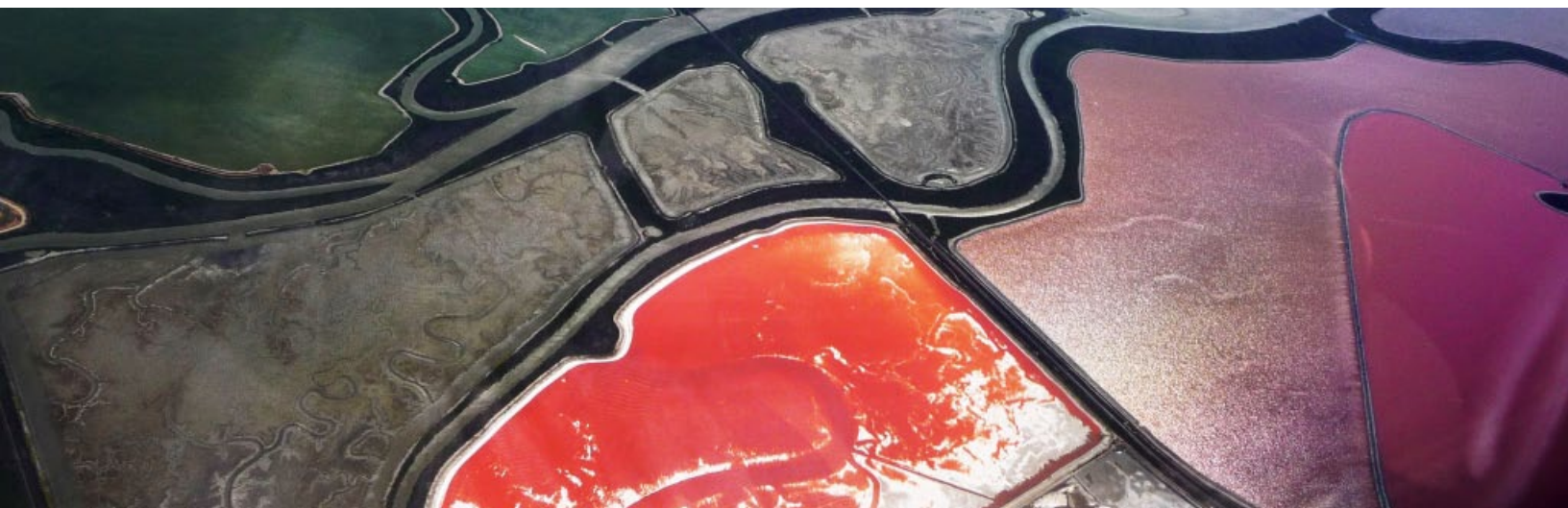
- a. Does it address toxics? Yes, Green Seal's standards addresses VOCs, performance, packaging, consumer education, and toxics.
- b. Is there continued, balanced measurements and comparability? Does it maintain a level of scrutiny to all products, both new and old? Yes

### *Energy Star*

The ENERGY STAR Challenge intends to improve the energy efficiency of America's commercial and industrial buildings by 10 percent or more. There are many state and local efforts that refer to ENERGY STAR tools, such as Target Finder for new building or Portfolio Manager to track energy use, energy costs, and carbon emissions in existing buildings. For example, the District of Columbia programs include:

- the Green Building Act of 2006 which requires District-owned commercial buildings to be "Designed to achieve 75 points on the EPA national energy performance rating system as determined by the ENERGY STAR Target Finder tool" and benchmarked annually in EPA's Portfolio Manager; and
- the Clean and Affordable Energy Act of 2008 which requires that, beginning in 2010, eligible privately-owned commercial buildings be benchmarked using Portfolio Manager on an annual basis. Statements of energy performance will be published on a publicly available online database.

ENERGYSTAR itself is a joint program launched by the US DOE and US EPA. ENERGYSTAR indicates that devices carrying the Energy Star logo, such as computer products and peripherals, kitchen appliances, buildings and other products, save 20%-30% of energy use on average.



*"South San Francisco Bay, California." Photo Credit: Jonathan Herz*

The ENERGYSTAR program uses third-party validation and recognition as drivers for improving a building or product's energy management. This includes partnership programs, widely recognized performance standards, awards, and public reporting.

How does ENERGYSTAR Challenge compare against sustainability principles?

ENERGYSTAR has moved markets to greater efficiency. However, ENERGYSTAR only addresses one environmental and social attribute within one life cycle phase. And the Energy Star label process allows manufacturers to self-certify their products.

**1. Sustainable Scale:**

- a. Does it address if the product returns to a reusable or biodegradable state? No
- b. Does it address whether or not the company is going to lessen the environmental impact of the product?  
ENERGYSTAR is tightly focused on energy use, energy costs, and their reflective impact upon carbon emissions.
- c. Does it address what happens when the product wears out? Or whether or not there is a process or incentive for take backs or recycling? No
- d. Does it address whether or not environmental accountability is required of the suppliers? No

**2. Toxics:** Not addressed

**3. Just Distribution:**

- a. Does it address whether or not the product manufacturer put back into the community? No

**4. Efficient Allocation:**

- a. Does it address whether the product is the best solution to the problem? No

**LCA for Whole Building Evaluation**

*ATHENA Version 4 (Dec 2008 release)*

Athena 4 is an Environmental Impact Estimator (EIE) that evaluates whole buildings and assemblies based on LCA methodology. It allows users to compare the environmental implications of industrial, institutional, commercial and residential designs—both for new buildings and major renovations.

The Impact Estimator is a whole building environmental life cycle based decision support tool for use by designers, product specifiers, and policy analysts at the conceptual stage of a project, when key decisions are made about the shape and material make up of a building's structure and envelope.

The impact Estimator is capable of simulating over 1,200 different assembly combinations and is applicable to about 95% of the building stock in North America. It has the ability to compare five different scenarios across a set of selected environmental impact measures and it tracks embodied primary energy use, global warming potential, solid waste emissions, air pollutants, water pollutants, weighted resource use.


The Estimator takes into account the environmental impacts of:

- Materials manufacturing, including resource extraction and recycled content
- Related transportation
- On-site construction
- Regional variation in energy use, transportation and other factors
- Building type and assumed lifespan
- Demolition and disposal
- Operating energy emissions and pre-combustion effects

Results are then provided in terms of cradle to grave for: embodied energy, acidification, global warming, human health respiratory effects, ozone depletion, smog, aquatic eutrophication, and weighted resource use.



*"NOAA Center for Weather and Climate Prediction, Riverdale Park, Maryland." Courtesy of HOK*



Database Management: Data is extracted from the US LCI Database Project and Canadian Database. Indicators include: Resource extraction, Manufacturing and on-site construction, recycled content, transportation, Maintenance, Demolition and land filling, and Operating energy effects.

How does ATHENA 4 compare against sustainable principles?

### **1. Sustainable Scale:**

- a. Does it address if the user needs a new building? No
- b. Does it provide a life-cycle plan from design through construction to operations and management?  
Yes; extensively.
- c. Does it address the context of the project? Whether or not the company is going to lessen the environmental impact? Is it on a rural Greenfield or an Urban infill? What region is the building in?  
Yes; extensively.
- d. Does it address whether or not the building minimizes the use of non-renewable resources? Yes

### **2. Just Distribution**

- a. Does it address whether or not the product manufacturer put back into the community? No
- b. Does it address whether or not the building makes people flourish? Yes
- c. Does it address if the building is aesthetically pleasing? No
- d. Does it address if the building meets program needs and allow the users to be productive? Does it address if the users are happy with their space? Yes
- e. Does it address if the building negatively affect the user's health? Yes. To an extent; ATHENA 4 heavily concentrates upon human health effects which can impact user productivity level.

### **3. Efficient Allocation**

- a. Economy: Does it address whether the product is the best solution to the problem? No

#### 4. Toxics:

- a. Is there continued, balanced measurements and comparability? Does it maintain a level of scrutiny to all products, both new and old? Yes; users are able to compare current and past analyses.

### LCA for Specific Building Materials and Systems

#### *EPA's EPP Program*

EPA's Environmentally Preferable Purchasing Program (EPP) started in 1993 after the signing of Executive Order 12873, and continues under Executive Order 13423. EPA's Environmentally Preferable Purchasing (EPP) Program is helping agencies across the federal government comply with green purchasing requirements.

The intent of the project environmentally preferable means "products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose." This comparison applies to raw materials, manufacturing, packaging, distribution, use, reuse, operation, maintenance, and disposal.

Claimed Impact on Federal Purchasing:

- Improved ability to meet environmental goals
- Improved worker safety and health
- Reduced liabilities
- Reduced health and disposal costs
- Increased availability of environmentally preferable products in the marketplace

How does the EPP program compare against sustainability principles?

#### 1. Sustainable Scale:

- a. Does it address if the product returns to a reusable or biodegradable state? Yes
- b. Does it address whether or not the company is going to lessen the environmental impact of the product? Yes
- c. Does it address what happens when the product wears out? Or whether or not there is a process or incentive for take backs or recycling? Yes
- d. Does address whether or not environmental accountability is required of the suppliers? Yes
- e. Does it address Toxics? Yes

## 2. Just Distribution:

- a. Ecology-Equity: Does it address whether or not the product manufacturer put back into the community? No

## 3. Efficient Allocation:

- a. Economy: Does it address whether the product is the best solution to the problem? Products are addressed on a comparable basis to one another, which may or may not provide the best solution.

### *Pharos*

Pharos can be used to evaluate building materials against their impact upon health and pollution, environment and resources, and society and community. These include factors like embodied energy, indoor air quality, water usage, toxic materials, solid waste, global warming, and even corporate commitment to sustainability.

It has three elements: the Pharos Lens, the Pharos label, and Pharos Wiki. The Pharos lens is a graphically interactive tool for documenting the environmental and social performance of products in the marketplace. It is comprised of a series of wedges that are each assigned a different social or environmental issue. The number of wedges is currently not capped – meaning users can suggest and debate adding wedged priorities through Pharos Wiki, a virtual commons to share information about green building materials and the use of the other Pharos tools. The Pharos Project is still in development; Pharos v1 is currently being used to assess rating systems, verifiers, and products.



### Pharos Lens

*Courtesy of Pharos Project Wiki.*

How does the Pharos Project compare against sustainability principles?

**1. Sustainable Scale:**

- a. Does it address if the material or system returns to a reusable or biodegradable state?  
Not specifically, Pharos addresses manufacturing and end-use waste.
- b. Does it address whether or not the company is going to lessen the environmental impact of the product? Yes
- c. Does it address what happens when the product wears out? Or whether or not there is a process or incentive for take backs or recycling? Unknown; it will address waste issues but it's currently unknown whether that data will be upstream or downstream.
- d. Does address whether or not environmental accountability is required of the suppliers? No

**2. Toxics:** Yes

**3. Just Distribution**

- a. Does it address whether or not the product manufacturer put back into the community? Yes

**4. Does it address whether the product is the best solution to the problem?** Yes

*SimaPro*

Contains detailed and transparent life cycle inventory data on thousands of life-cycle assessment processes as it pertains to the manufacturing, distribution and use of materials and products. It stands for "System for Integrated Environmental Assessment of Products" and contains life cycle impact assessment methods using input-output data sets to ISO standards. It's described as compact and simple, "usable by those who intend to spend less than 10 days on LCA."

Database Management: Within the inventory results, emissions can be specified into air, water, soil, solid waste, and waste streams. Emissions can also be defined using the sub compartments used by Eco-invent.

Parameters can be defined directly by the user and it is possible to link an amount field directly to an external data source. If a comparison is made, SimaPro will show the difference between two product systems, which gives the user the chance to see if the difference between product systems are indeed relevant, and for which impact category.

How does SimaPro compare against sustainability principles?

**1. Sustainable Scale:**

- a. Does it address if the material or system returns to a reusable or biodegradable state?  
Not specifically, SimaPro addresses manufacturing and end-use waste
- b. Does it address whether or not the company is going to lessen the environmental impact of the product? Yes
- c. Does it address what happens when the product wears out? Or whether or not there is a process or incentive for take backs or recycling? Yes
- d. Does address whether or not environmental accountability is required of the suppliers? No

**2. Toxics:**

- a. Does it address toxics? Yes

**3. Just Distribution:**

- a. Does it address whether or not the product manufacturer put back into the community? No

**4. Efficient Allocation:**

- a. Does it address whether the product is the best solution to the problem? Yes

*GaBi 4.2*

GaBi 4.2 is software for Life Cycle Assessment (LCA), Life Cycle Engineering (LCE), Greenhouse Gas Accounting, Benchmarking and Energy Efficiency of products and companies. It includes 650 sets of data compiled by IKP/PE International. The software allows users to model process chains for metals, organic and non-organic products, synthetics, minerals, provisions of energy (steam, thermal energy, electricity mixes and power stations), and end of life disposal processes.

How does GaBi 4.2 compare against sustainability principles?

**1. Sustainable Scale:**

- a. Does it address if the material or system returns to a reusable or biodegradable state? Yes
- b. Does it address whether or not the company is going to lessen the environmental impact of the product? Yes
- c. Ecology: Does it address what happens when the product wears out? Or whether or not there is a process or incentive for take backs or recycling? Yes
- d. Does address whether or not environmental accountability is required of the suppliers? Yes



## 2. Toxics:

- a. Does it address toxics? Yes

## 3. Just Distribution:

- a. Does it address whether or not the product manufacturer put back into the community? No

## 4. Efficient Allocation:

- a. Does it address whether the product is the best solution to the problem? No

### *Umberto*

Umberto integrates both LCA and LCC in order to model material and energy flows throughout a product's entire life cycle. Umberto is most beneficial to companies with cost-intensive production that wish to optimize their processes and improve their competitiveness. This includes industries such as the chemical, semiconductor, waste management, and printing.

Within Umberto, a user creates projects defined by a list of products, raw materials, pollutants, and other forms of energy. These indicators are all referred to as materials and can be placed into a hierarchical listing based upon the user's priorities. The materials possess technical properties referred to as "caloric values". Technical properties can be ecological, such as the global warming potential or the toxicity of the material, to economic, the market value of the material. Outputs and comparisons are displayed as requested. The various fields of application include: energy supply, waste disposal, transport, provision of raw materials and basic materials such as plastics, metals, building material, fibers etc.

How does Umberto compare against sustainability principles?

## 1. Sustainable Scale:

- a. Does it address if the material or system returns to a reusable or biodegradable state?  
Not specifically; Umberto addresses waste disposal
- b. Does it address what happens when the product wears out? Or whether or not there is a process or incentive for take backs or recycling? Yes
- c. Does address whether or not environmental accountability is required of the suppliers? No
- d. Does it address whether or not the company is going to lessen the environmental impact of the product? Yes

## 2. Just Distribution:

- a. Does it address whether or not the product manufacturer put back into the community? No

## 3. Efficient Allocation:

- a. Does it address whether the product is the best solution to the problem? No

#### 4. Toxics:

- a. Is there continued, balanced measurements and comparability? Does it maintain a level of scrutiny to all products, both new and old? Yes.

### Life Cycle Costing (LCC) Tools: Buildings

#### *EnergyPlus*

This software models heating, cooling, lighting, ventilating, and other energy flows as well as water in buildings. EnergyPlus is originally based on the most popular features and capabilities of BLAST and DOE-2 and includes capabilities such as time steps of less than an hour, modular systems and plant integrated with heat balance-based zone simulation, multi-zone air flow, thermal comfort, water use, natural ventilation, and photovoltaic systems.

This is not a life cycle analysis tool. It produces results that can be fed into a LCC program.

How does EnergyPlus compare against sustainability principles?

#### 1. Sustainable Scale:

- a. Does it address if the user needs a new building? No
- b. Does it provide a life-cycle costing plan from design through construction to operations and management?
  - i. Design – Yes
  - ii. Operations and maintenance – Yes
  - iii. Re-use / recycle / deconstruct – No
  - iv. Lifecycle cost management – Yes
- f. Does it address the context of the project? Whether or not the company is going to lessen the environmental impact? Is it on a rural Greenfield or an Urban infill? What region is the building in? No
- g. Does it address whether or not the building minimizes the use of non-renewable resources? EnergyPlus is useful for evaluating the costs and benefits of energy conservation and renewable energy projects.

*"Northern New Mexico." Photo Credit: Jonathan Herz*



2. **Toxics:** Not addressed

3. **Just Distribution:**

- a. Does it address whether or not the building makes people flourish? Does it address if the building is aesthetically pleasing? Does it address if the building meets program needs and allow the users to be productive? Does it address if the users are happy with their space? Does it address if the building negatively affect the user's health? To an extent; the software models heating, cooling, lighting, and ventilating which when adequately addressed, will allow users to be productive and happy within their space.

4. **Efficient Allocation:** Not addressed

### **Life-Cycle Costing Tools: Economic Analysis**

All life cycle costing (LCC) tools must be used in conjunction with other strategies. Discount rates and other strategies can be problematic. For instance, in cost benefit analysis, "discounting" is used to estimate the present day value of benefits and costs that accrue over time. It makes sense in a purely financial decision, such as when we consider the present day value of interest that could be obtained by investing money over time, rather than spending it now. When applied to things that are not easy to price, such as ecosystem services, discounting can jeopardize sustainability goals by favoring actions in the present whose cost impacts are mainly in the future.

Furthermore, choosing discount rates beyond a single generation raises questions about equity, since it assumes that the same resource, or an identical substitute, will always be available and that future generations will be able to absorb the costs of our actions today.

#### *Building Life-Cycle Cost (BLCC)*

BLCC was developed by NIST. It conducts economic analyses by evaluating the relative cost effectiveness of alternative buildings and building-related systems or components. i.e. The LCC of two or more alternative designs are computed and compared to determine which has the lowest LCC and is therefore more economical in the long run.

It is especially useful for evaluating the costs and benefits of energy and water conservation and renewable energy projects. BLCC also calculates comparative economic measures for alternative designs, including Net Savings, Savings-to-Investment Ratio, Adjusted Internal Rate of Return, and Years to Payback.

This is not a life cycle analysis tool. The software can evaluate federal, state, and local government projects for both new and existing buildings.

Costs can be categorized as :

- initial investment costs,
- operation and maintenance costs,
- energy costs and water costs,
- capital replacement costs,
- residual values, and
- financing costs.

How does BLCC compare against sustainability principles?

### 1. Sustainable Scale:

- a. Does it provide a life-cycle plan from design through construction to operations and management?
  - i. Design – Yes
  - ii. Operations and maintenance – Yes
  - iii. Re-use / recycle / deconstruct – No
  - iv. Lifecycle cost management - Yes BLCC only address LCC for initial investments and operations.
- b. Does it address the context of the project? Whether or not the company is going to lessen the environmental impact? Is it on a rural Greenfield or an Urban infill? What region is the building in? No
- c. Does it address whether or not the building minimizes the use of non-renewable resources? BLCC is useful for evaluating the costs and benefits of energy and water conservation and renewable energy projects.

### 2. Toxics: Not addressed

### 3. Just Distribution:

- a. Does it address if the building is aesthetically pleasing? Does it address if the building meets program needs and allow the users to be productive? Does it address if the users are happy with their space? Does it address if the building negatively affect the user's health? No; however, BLCC has the capability of estimating annual and lifecycle CO<sub>2</sub>, SO<sub>2</sub>, and NO<sub>x</sub> emissions in parallel with the energy use of the building or building system being evaluated.

### 4. Efficient Allocation: Not addressed



## *ECONPACK*

ECONPACK incorporates economic analysis calculations, documentation and reporting capabilities. It is structured towards non-economists to prepare documented economic analysis (EA) in support of DOD funding requests. ECONPACK is geared towards standardized economic analysis for capital investments such as barracks, hospitals, family housing, information systems, utility plants, maintenance facilities, etc.

How does ECONPACK compare against sustainability principles?

### **1. Sustainable Scale:**

- a. Does it address if the user needs a new building? No
- b. Does it provide a life-cycle plan from design through construction to operations and management?
  - i. Design – Yes
  - ii. Operations and maintenance – Yes
  - iii. Re-use / recycle / deconstruct – No
  - iv. Lifecycle cost management - Yes ECONPACK is a generic LCC for specific investment categories related to the DOD and government.
- c. Does it address the context of the project? Whether or not the company is going to lessen the environmental impact? Is it on a rural Greenfield or an Urban infill? What region is the building in? No
- d. Does it address whether or not the building minimizes the use of non-renewable resources? No

### **2. Just Distribution:**

- a. Does it address whether or not the building makes people flourish? Does it address if the building is aesthetically pleasing? Does it address if the building meets program needs and allow the users to be productive? Does it address if the users are happy with their space? Does it address if the building negatively affect the user's health? No

### **3. Efficient Allocation: Yes**

*"Human Rights Campaign headquarters building, Washington, DC." Courtesy of HOK*



## Life-Cycle Costing Tools: Energy Use

### *Facility Energy Decision System (FEDS)*

FEDS 6.0 was developed at Pacific Northwest National Laboratory (PNNL) with the support of the U.S. Army Installation Management Agency Southeast Region, U.S. Coast Guard, Tennessee Army National Guard, and the Canadian government.

It identifies minimum life cycle cost retrofits, determining payback, and enabling users to prioritize options for meeting energy efficiency goals. FEDS contains a built-in database of building survey data and is able to infer a number of building parameters based on the small set of required (minimum set) inputs by the user.

For example, information such as building type, location, floor area, and vintage can be used to model buildings without having intimate knowledge of the detailed engineering parameters. Hourly weather data, energy simulation and financial engines determine energy consumption, electric demand, and calculate the cost effectiveness of potential retrofits. Additionally, FEDS determines the impact of retrofit projects on emissions of CO, CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>2</sub>, hydrocarbons, and particulates.

How does FEDS compare against sustainability principles?

FEDS strictly focuses on energy use. It does not address sustainable scale, toxics, just distribution, and efficient allocation.

### *ENERGY-10*

ENERGY-10 is a design tool that analyzes—and illustrates—the energy and cost savings that can be achieved through more than a dozen sustainable design strategies. It is a whole-building design tool that enables designers to test energy use and costs of their design. Hourly energy simulations help the user quantify, assess, and clearly depict the benefits of technologies such as daylighting, passive solar heating, natural ventilation, well-insulated envelopes, better windows, lighting systems, mechanical equipment, and more.

The simulation software is suitable for examining small commercial and residential buildings that are characterized by one, or two thermal zones (generally less than 10,000 ft<sup>2</sup>.)

ENERGY-10 is the key tool in SBIC's Small Commercial Buildings program. It covers 16 energy-efficiency strategies that software users need to understand in order to use it effectively:

- Daylighting
- Lighting controls
- Glazing
- Insulation
- Shading
- Air leakage control
- Energy-efficient lighting
- Thermal mass

How does Energy-10 compare against sustainability principles?

Energy-10 strictly focuses on energy use. It does not address sustainable scale, toxics, just distribution, and efficient allocation.

## Multi-Criteria Analysis

### *NOAA's Habitat Priority Planner*

NOAA's Coastal Services Center provides a tool to review alternatives for coastal development that quantifies economic, environmental, and social impacts. The "Habitat Priority Planner" looks beyond smart growth and towards a perfect balance between the natural and built environment by preparing and analyzing hypothetical development scenarios.

For example, in coastal Georgia, NOAA worked to integrate life cycle concepts, consensus-based standards, and performance measurement and verification methods into three hypothetical designs: conventional, new urbanism, and conservation scenarios. The approach used local partners and science based skills and technologies to evaluate each. From there, the team began with a list of potential economic, environmental, and social indicators to measure hypothetical impacts from the various scenarios on the surrounding environment. Factors such as whether or not the site location was within a region or watershed were important. As the project moved forward, the team discussed and refined its indicators - life cycle analysis, local consensus, performance measurements and verification methods all influenced the achievement of a sustainable development.

Rather than jumping to an assumed "less bad" approach, this process focused on a coalition of views and indicators in order to omit dictation of judgment from a single stakeholder category. This structure assesses multiple value systems and objectives, not easily quantified, to develop a scenario that works best for the community and its surrounding environment.

You can view these project results on NOAA's Web site at: (<http://www.csc.noaa.gov/digitalcoast/tools/hpp/>). The Web site is structured to allow users to walk through the project processes and results. It is a valuable educational tool that provides information and promotes dialog with local government officials, planners, developers, and citizens in the communities they serve.

How does NOAA Habitat Priority Planner compare against sustainability principles?

**1. Sustainable Scale:**

- a. Does it address if the user needs a new building? No
- b. Does it provide a life-cycle plan from design through construction to operations and management? Yes
- c. Does it address whether or not the company is going to lessen the environmental impact? Yes
- d. Does it address if the project is on a rural Greenfield or an Urban infill? Yes
- e. Does it address region? Yes
- f. Ecology: Does it address whether or not the building minimizes the use of non-renewable resources? Yes
- g. Ecology: Does it address whether or not toxics are used? Possibly. Measured indicators are determined by individual teams.

**2. Just Distribution:**

- a. Does it address whether or not it makes people flourish? Yes
- b. Does it function to meet program needs and allow the users to be productive? Yes

**The Tools Matrix**

Moving towards a sustainable world requires an understanding of sustainability and natural systems. Sustainable operations are those that, to the greatest extent practicable, use only goods and services that:

- consume non-renewable resources at a rate below that at which they can be replaced by renewable substitutes, if any,
- prevent pollution or generate waste at rates below the ecosystem's assimilative capacity,
- eliminate virgin material requirements and 'close the loop' by using recycled and/or recyclable materials, and
- maintain critical ecosystems that provide essential life support.



The following are matrices and graphics that consolidate and organize the tools reviewed above. The intent is - to identify closed-loop transformative practices, far from the typical baseline, and its relevant tool that may enables us to achieve that practice, if any. These matrices can help users make informed choices between competing tools and strategies to encourage better solutions.

The tools reflect the following transformative criteria:

- give priority to human and ecosystem health, safety and welfare,
- restore and protect public goods and services such as clean air and water,
- prevent, rather than remedying the harmful results of economic activities through pollution prevention and toxics elimination, and
- integrate economics with the physical and life sciences so that decisions respect the interrelations among economic, environmental and social sustainability.

These matrices are a first step towards identifying sustainability tools. It is not meant to be comprehensive. Other tools are available and should be evaluated with the same goals in mind.



[www.noaa.gov](http://www.noaa.gov)

## SITE

Sustainable Goal	Transformative Practice	Applicable Tool
Maintain, protect, and enhance the surrounding environment.	Living systems and local climate are reflected within the building design, the surrounding landscape, and operations of a building. The site's character should be very much rooted in the existing plant material and topography.	Biomimicry: discipline that studies nature's best ideas and then imitates these designs and processes to solve human problems.
Minimize development on Greenfields and maximize development on land that will have the least environmental impact.	Minimize footprint, bring development towards urban centers, and use existing buildings and local/natural materials.	NOAA's Habitat Priority Planner: an approach to quantify the economic, environmental, and social impacts of a development.  LEED: an internationally recognized green building certification system.  Athena: an Environmental Impact Estimator (EIE) that evaluates whole buildings and assemblies based on LCA methodology.
Take into account climate change.	Take advantage of local experts to integrate resilient development. Divergence from coastlines, wetlands and sensitive zones to manage flood risks. Minimize urban heat island affect with reflective or vegetative surfaces.	NOAA's Habitat Priority Planner: an approach to quantify the economic, environmental, and social impacts of a development.
Reduce GHGs: promote sustainable and efficient transportation.	Incentives for electric hybrid vehicle use and multiple mass transit options. Providing a site with access to public transportation will help to curb vehicle emissions that contribute to smog and harmful air quality as well as the continued use of oil extraction. Mass transit eases traffic congestion and the harmful demands it causes upon the environment. Encourage healthy lifestyles through the promotion of pathways that create a safe and healthy workplace by supporting staff who want to achieve and/or maintain active lifestyles. Use smart Conference Rooms that minimize travel.	NOAA's Habitat Priority Planner: an approach to quantify the economic, environmental, and social impacts of a development.  LEED: an internationally recognized green building certification system.
Reduce impact upon municipal stormwater systems; minimize environmental impact.	Design stormwater management approaches that emphasize conservation, minimization techniques, pollution prevention measures and runoff. Areas with occurrences of combined sewer overflows (CSOs) require zero stormwater impact through strategies such as pervious pavement, green roofs, or rainwater capture and re-use.	NOAA's Habitat Priority Planner: an approach to quantify the economic, environmental, and social impacts of a development.  LEED: an internationally recognized green building certification system.
Restricted use of potable water for landscaping needs (greywater recycling and rainwater harvesting).	Overcome environmental, health, and technical barriers towards widespread water recycling and increased rainwater harvesting.	Unknown
Community Connectivity: supporting wellness at work and within the community.	Promote access to decent, appropriate and affordable housing. Encourage healthy lifestyles through the promotion of pathways that create a safe and healthy workplace by supporting staff who want to achieve and/or maintain active lifestyles.	NOAA's Habitat Priority Planner: an approach to quantify the economic, environmental, and social impacts of a development.

# HABITAT



BASELINE 

 TRANSFORMATIVE

# TRANSPORTATION



BASELINE 

 TRANSFORMATIVE

# COMMUNITY



BASELINE



TRANSFORMATIVE

# WATER



BASELINE



TRANSFORMATIVE

## WATER

Sustainable Goal	Transformative Practice	Applicable Tool
<p>Minimize impacts on the consumption of energy, water and other resources due to waste growth.</p>	<p>Required 40% water-use reduction from current baseline standards for water sensitive areas (e.g. Phoenix, Texas, Florida, and California) through waterless urinals, greywater re-use, etc., as well as stronger backing for innovative natural wastewater technologies. Other improvements should include new Building Regulations which require water efficient measures to be incorporated especially within affordable housing.</p>	<p>Unknown</p>
<p>Closed Loop water supply: sustainably provide potable water by naturally treating wastewater on-site. It can then be recycled for flushing or irrigation needs. Treating wastewater on-site reduces demand upon local treatment facilities and water transportation requirements.</p>	<p>Use of multi-criteria analysis to operate sustainable mechanisms for water treatment. Maximized use of technologies such as: solar desalination, natural treatment systems, water conservation (e.g. waterfree urinals, low-flow aerators and composting toilets).</p>	<p>Unknown</p>

## HUMAN HEALTH

Sustainable Goal	Transformative Practice	Applicable Tool
<p>Improve surrounding air quality by minimizing development on Greenfields and maximizing development on land that will have the least environmental impact.</p>	<p>Minimize footprint, bring development towards urban centers, and use existing buildings and local/natural materials. Encouraging development near or within urban areas will help to increase the use of public transportation and curb vehicle emissions that contribute to smog and harmful air quality as well as the continued use of oil extraction. Mass transit eases traffic congestion and the harmful demands it causes upon the environment.</p>	<p>LEED: an internationally recognized green building certification system.</p> <p>NOAA's Habitat Priority Planner: an approach to quantify the economic, environmental, and social impacts of a development.</p>
<p>Construction Practices: Create a construction environment absent of toxins and other harmful health compounds through high quality and natural materials and use of sustainable construction methods.</p>	<p>Implement technologies to promote occupant health, comfort, and productivity through the elimination of toxins and harmful substances.</p>	<p>GaBi 4.2: software for Life Cycle Assessment (LCA), Life Cycle Engineering (LCE), Greenhouse Gas Accounting, Benchmarking and Energy Efficiency of products and companies.</p> <p>The Pharos Project: used to evaluate building materials against their impact upon health and pollution, environment and resources, and social and community.</p> <p>McDonough Braungart Design Protocol (MBDC): a Cradle to Cradle Design Protocol to evaluate a product based upon its chemical hazard, recyclability and recycled content, energy and water use and some social responsibility.</p> <p>Umberto: models material and energy flows throughout a building material's entire life cycle.</p>
<p>Indoor Air Quality: Create an indoor environment absent of toxins and other harmful health compounds through high quality and natural products.</p>	<p>Use low-emitting materials to preserve healthy indoor air by reducing the level harmful emissions and toxins permitted in the building. Many new building products outgas Volatile Organic Compounds (VOCs) and formaldehyde, among other toxic chemicals. Educate facilities' staff to support the goals, technologies, and sustainable operations of the building.</p>	<p>McDonough Braungart Design Protocol (MBDC): a Cradle to Cradle Design Protocol to evaluate a product based upon its chemical hazard, recyclability and recycled content, energy and water use and some social responsibility.</p> <p>GREENGUARD: establishes acceptable indoor air standards for Indoor Air Quality, Schools, and Building &amp; Construction.</p> <p>EPA's Environmentally Preferable Purchasing Program (EPP): a program that helps government agencies comply with green purchasing requirements.</p>

## PEOPLE/INDOOR ENVIRONMENT



**BASELINE** **TRANSFORMATIVE**

## CONSTRUCTION PRACTICE AND WASTE ELIMINATION

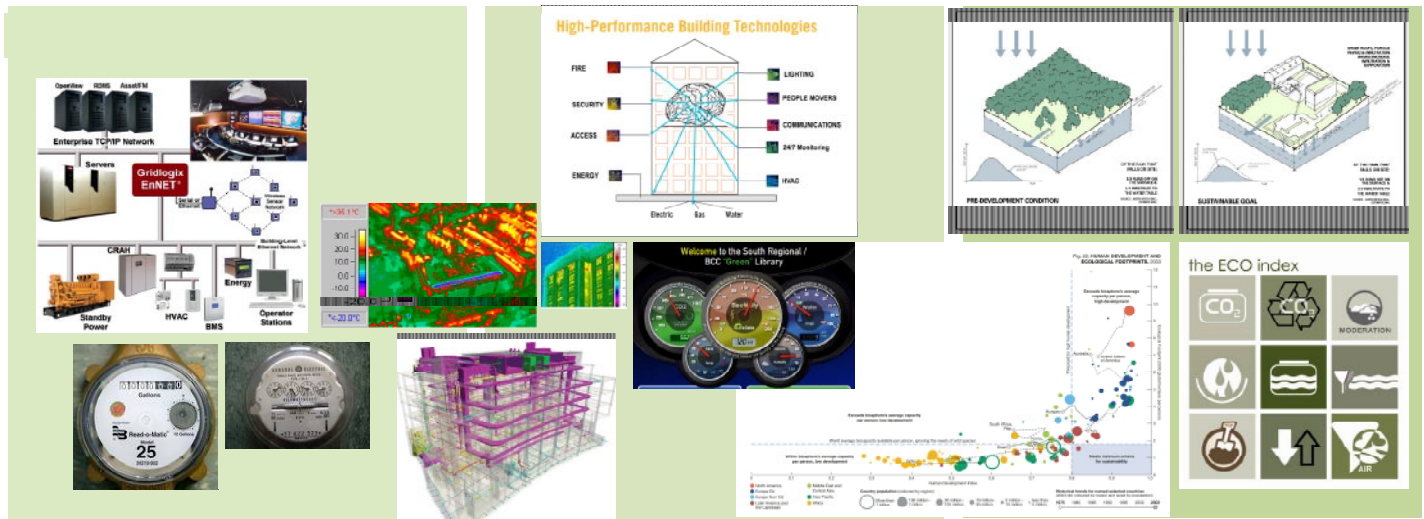
Sustainable Goal	Transformative Practice	Applicable Tool
<p>Closed Loop Practices. No cumulative impact identified, and potential is mitigated by development control policies.</p>	<p>Implement processes and protocols that minimize resource utilization, waste, and life cycle environmental impacts from building construction, renovation, and demolition:</p> <ol style="list-style-type: none"> <li>1. Deconstruction first, demolition second</li> <li>2. Streamline construction processes that re-use furniture, building materials, recycled construction materials</li> </ol>	<p>Green Recycling Network (GRN): full deconstruction services of commercial buildings using a disassembly process with the objective to recover materials for re-use. GRN landfill diversion rates regularly exceed 90% of materials such as such as carpeting, drywall, metal, ceiling tile, stained/painted wood, glass, etc. while following EPA's comprehensive guidelines for the construction, renovation.</p> <p>(<a href="http://greenrecyclingnetwork.com/2009/">http://greenrecyclingnetwork.com/2009/</a>)</p> <p>The Construction Waste Management Database contains information on companies that haul, collect and process recyclable debris from construction projects. Created in 2002 by GSA's Environmental Strategies and Safety Division to promote responsible waste disposal, the Database is a free online service for those seeking companies that recycle construction debris in their area.</p> <p>(<a href="http://www.wbdg.org/tools/cwm.php?u=5">http://www.wbdg.org/tools/cwm.php?u=5</a>)</p>

## BUILDING MATERIALS AND PRODUCTS

Sustainable Goal	Transformative Practice	Applicable Tool
<p>Use only those goods and services that, in their production use and distribution, conserve, recover and continuously recycle natural resources and restore ecosystem services in a closed-loop manner.</p>	<p>Conduct life-cycle assessments for building products, materials, and services. Take into account toxicity and volatile compounds.</p>	<p><u>Building Materials:</u>            GaBi 4.2: software for Life Cycle Assessment (LCA), Life Cycle Engineering (LCE), Greenhouse Gas Accounting, Benchmarking and Energy Efficiency of products and companies.             The Pharos Project: used to evaluate building materials against their impact upon health and pollution, environment and resources, and social and community.             McDonough Braungart Design Protocol (MBDC): a Cradle to Cradle Design Protocol to evaluate a product based upon its chemical hazard, recyclability and recycled content, energy and water use and some social responsibility.            Umberto: models material and energy flows throughout a building material's entire life cycle.   <u>Products:</u>            McDonough Braungart Design Protocol (MBDC): a Cradle to Cradle Design Protocol to evaluate a product based upon its chemical hazard, recyclability and recycled content, energy and water use and some social responsibility.             GREENGUARD: establishes acceptable indoor air standards for Indoor Air Quality, Schools, and Building &amp; Construction.             EPA's Environmentally Preferable Purchasing Program (EPP): a program that helps government agencies comply with green purchasing requirements.</p>



# MEASUREMENT



**BASELINE** 

 **TRANSFORMATIVE**

## ENERGY AND TECHNOLOGY

Sustainable Goal	Transformative Practice	Applicable Tool
Net-zero energy, sustainable high-performance buildings	Create a high quality design through use of sustainable construction methods, ultra energy efficient electronics and building systems.	<p>ENERGY-10: a design tool that analyzes—and illustrates—the energy and cost savings that can be achieved through more than a dozen sustainable design strategies.</p> <p>EnergyPlus: This software models heating, cooling, lighting, ventilating, and other energy flows as well as water in buildings.</p> <p>FEDS 6.0: facilitates the assessment and analysis of energy efficiency opportunities in buildings. It identifies minimum life cycle cost retrofits, determining payback, and enabling users to prioritize options for meeting energy efficiency goals.</p>

# glossary



**Abiotic Resource**

A nonliving resource that cannot reproduce: fossil fuels, minerals, water, land, and solar energy.

**Acid Rain**

The result of sulfur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>) reacting in the atmosphere with water and returning to earth as rain, fog, or snow. Broadly used to include both wet and dry deposition. (US EPA)

**Adaptation**

Adjustment in natural or human systems to a new or changing environment. Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation.

**Allocation**

The process of apportioning resources to the production of different goods and services. Neoclassical economics focuses on the market as the mechanism of allocation. Ecological economics recognizes that the market is only one possible mechanism for allocation.

**Backcasting**

A method in which the future desired conditions are envisioned and steps are then defined to attain those conditions, rather than taking steps that are merely a continuation of present methods extrapolated into the future.

**Biocapacity**

The capacity of a given biologically productive area to generate an on-going supply of renewable resources and to absorb its spillover wastes. If an ecological footprint exceeds its biocapacity, it is not sustainable.

**Biotic Resource**

A living resource, such as trees, fish, and cattle (elements of ecosystem structure), as well any of the services they provide, such as climate regulation, water regulation, and waste-absorption capacity (ecosystem functions, or ecosystem services).

**Cadmium**

Cadmium was once used as pigment and for corrosion resistant plating on steel and to stabilize plastic. With the exception of its use in nickel-cadmium batteries, the use of cadmium is generally decreasing in all other applications due to the high toxicity and carcinogenicity.





### **Carbon Dioxide (CO<sub>2</sub>)**

A naturally occurring gas made of carbon and oxygen. Sources of carbon dioxide in the atmosphere include animals, which exhale carbon dioxide, and the burning of fossil fuels and biomass.

### **Carrying Capacity**

Originally the maximum population of cattle that can be sustained on a given area of rangeland. By extension the population of humans that can be sustained by a given ecosystem at a given level of consumption, with a given technology.

### **Clean Air Act**

The law that defines the US EPA's responsibilities for protecting and improving the nation's air quality and the stratospheric ozone layer. The last major change in the law, the Clean Air Act Amendments of 1990, was enacted by Congress in 1990.

### **Climate**

Usually defined as the "average weather," or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands of years. The classical period is 3 decades, as defined by the World Meteorological Organization (WMO). These quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system.

### **Climate Change**

Any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer). Climate change may result from:

- natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun;
- natural processes within the climate system (e.g. changes in ocean circulation);
- human activities that change the atmosphere's composition (e.g. through burning fossil fuels) and the land surface (e.g. deforestation, reforestation, urbanization, desertification, etc.).

### **Closed System**

A system that imports and exports energy only, matter circulates within the system but does not flow through it. The Earth closely approximates a closed system.

**Corporate Social Responsibility (CSR)**

A form of corporate self-regulation integrated into a business model.

**Cost Benefit Analysis (CBA)**

A type of economic evaluation in which both the costs and consequences of different interventions are expressed in monetary units.

**Deforestation**

Those practices or processes that result in the conversion of forested lands for non-forest uses. This is often cited as one of the major causes of the enhanced greenhouse effect for two reasons: 1) the burning or decomposition of the wood releases carbon dioxide; and 2) trees that once removed carbon dioxide from the atmosphere in the process of photosynthesis are no longer present.

**Desertification**

Land degradation in arid, semi-arid, and dry sub-humid areas resulting from various factors, including climatic variations and human activities. The United Nations Convention to Combat Desertification defines land degradation as a reduction or loss, in arid, semi-arid, and dry sub-humid areas, of the biological or economic productivity and complexity of rain-fed cropland, irrigated cropland, or range, pasture, forest, and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as: (i) soil erosion caused by wind and/or water; (ii) deterioration of the physical, chemical and biological or economic properties of soil; and (iii) long-term loss of natural vegetation. Conversion of forest to non-forest.

**Development**

The improvement in quality of goods and services, as defined by their ability to increase human well-being, provided by a given throughput.

**Dioxins (PCDDs, PCDFs)**

A group of chlorinated organic chemicals with similar chemical structures that act as pollutants. According to the most recent US EPA data, the major sources of dioxins are:

- Coal fired utilities
- Municipal waste incinerators[1]
- Metal smelting
- Diesel trucks
- Land application of sewage sludge
- Burning treated wood
- Trash burn barrels

These sources together account for nearly 80% of dioxin emissions. Dioxins are also generated in reactions that do not involve burning — such as bleaching fibers for paper or textiles, and in the manufacture of chlorinated phenols, particularly when reaction temperature is not well controlled.

**Discounting or discount rate**

In economic decision making, the rate at which the present is valued over the future, as a result of uncertainty, or of productivity, or of pure time preference for the present.

**Ecological Footprint**

The ecological footprint is a measure of human demand on the Earth's ecosystems. It compares human demand with planet Earth's ecological capacity to regenerate. It represents the amount of biologically productive land and sea area needed to regenerate, representing the amount of biologically productive land and sea area needed to regenerate the resources a human population consumes and to absorb and render harmless the corresponding waste. Using this assessment, it is possible to estimate how much of the Earth (or how many planet Earths) it would take to support humanity if everybody lived a given lifestyle.

**Ecosystem**

All living things and non-living things in an area, as well as the interactions between them. (US EPA)

**Efficient Allocation**

The basis of traditional economics, which maximizes the utility of resources through a properly functioning marketplace.

**Entropy (see Thermodynamics)****Environmental Economics**

The branch of neoclassical economics that addresses environmental problems such as pollution, negative externalities, and valuation of nonmarket environmental services. In general, environmental economics focuses almost exclusively on efficient allocation, and accepts the pre-analytic vision of neoclassical economics that the economic system is the whole, and not a subsystem of the containing and sustaining global ecosystem.

**Environmental Management System (EMS)**

A set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency.

**Externalities**

An unintended and uncompensated loss or gain in the welfare of one party resulting from an activity by another party.

**Fossil Fuels**

Petroleum, coal, natural gas. Fuels formed over geologic ages from biotic materials, but now treated as nonrenewable abiotic resources.

**Fuel Cells**

A fuel cell is an electrochemical conversion device. It produces electricity from fuel (on the anode side) and an oxidant (on the cathode side), which react in the presence of an electrolyte. The reactants flow into the cell, and the reaction products flow out of it, while the electrolyte remains within it.

**Free Rider**

In economics, one who enjoys the benefit of public good without paying a share of the cost of its provision and maintenance.

**Globalization**

The economic integration of the globe by free trade, free capital mobility, and to a lesser extent by easy migration. It is the effective erasure of national boundaries for economic purposes.

**Global Warming**

An average increase in the temperature of the atmosphere near the Earth's surface and in the troposphere, which can contribute to changes in global climate patterns. Global warming can occur from a variety of causes, both natural and human induced. In common usage, "global warming" often refers to the warming that can occur as a result of increased emissions of greenhouse gases from human activities.

**Greenhouse Gases**

Gases that occur naturally in the Earth's atmosphere and trap heat to keep the planet warm. Some examples are carbon dioxide, water vapor, halogenated fluorocarbons, methane, hydrofluorocarbons, nitrous oxide, perfluorinated carbons, and ozone. Some human actions, like the burning of fossil fuels, also produce greenhouse gases. (US EPA)

**Habitat**

The place where an animal or plant lives and grows such as a forest, lake, or stream.



*"U.S. EPA Environmental Research Center, Research Triangle Park, North Carolina." Courtesy of HOK*



### **Heat Pollution**

A term used to describe the release of heat into the environment by human activities. Developed environments like concrete and black roads absorb and store heat. The urban heat island effect is the trapping of heat in thermal mass and is ultimately emitted back into the urban air especially at night. Urban heat island effect has been known to have human livability implications, ranging from the aggravation of health problems such as hyperthermia, increasing the intensity of urban air pollution, and contributing to extreme heat waves. Higher temperatures also result in higher cooling demands increasing energy use and potentially resulting in brownouts and higher greenhouse gas emissions. Heat from vehicles, manufacturing plants, and thermal power stations also contribute to excess heat in urban areas.

### **Human Needs Assessment**

A multidimensional concept of welfare that goes beyond income and wealth to include capabilities, capacities, and other existential categories used to measure the extent to which human needs are satisfied. These indicators go beyond the strictly economical GNP approach of basing human welfare upon a country's market value of goods and services purchased by households, government, and foreigners within the current year.

### **Hydrochlorofluorocarbons (HCFCs)**

Compounds containing hydrogen, fluorine, chlorine, and carbon atoms. Although ozone depleting substances, they are less potent at destroying stratospheric ozone than chlorofluorocarbons (CFCs). They have been introduced as temporary replacements for CFCs and are also greenhouse gases. See ozone depleting substance. HFCs were introduced as alternatives to ozone depleting substances in serving many industrial, commercial, and personal needs. HFCs are emitted as by-products of industrial processes and are also used in manufacturing. They do not significantly deplete the stratospheric ozone layer, but they are powerful greenhouse gases with global warming potentials ranging from 140 (HFC-152a) to 11,700 (HFC-23).

### **Hydrological Power**

Energy that is generated by dams, which use water to turn turbines and generate electricity.

### **Just Distribution**

Allocation of the Earth's finite resources so that all can live with respect.



### **Life Cycle Assessment (LCA)**

Process of comparing the environmental performance of products. A life-cycle assessment must consider all steps from cradle to grave: raw material production, processing, use and disposal, and transportation.

### **Life Cycle Cost Analysis (LCCA)**

A method for assessing the total cost of facility ownership. It takes into account all costs of acquiring, owning, and disposing of a building or building system. LCCA is especially useful when project alternatives that fulfill the same performance requirements, but differ with respect to initial costs and operating costs, have to be compared in order to select the one that maximizes net savings. For example, LCCA will help determine whether the incorporation of a high-performance HVAC or glazing system, which may increase initial cost but result in dramatically reduced operating and maintenance costs, is cost-effective or not. LCCA is not useful for budget allocation. (Whole Building Design Guide)

### **Life Cycle Costing**

Life-cycle cost (LCC) is the most straightforward measure of economic evaluation. Some other commonly used measures are Net Savings (or Net Benefits), Savings-to-Investment Ratio (or Savings Benefit-to-Cost Ratio), Internal Rate of Return, and Payback Period. They are consistent with the Lowest LCC measure of evaluation if they use the same parameters and length of study period. Building economists, certified value specialists, cost engineers, architects, quantity surveyors, operations researchers, and others might use any or several of these techniques to evaluate a project. The approach must be carefully applied when making cost-effective choices for building-related projects whether it is called cost estimating, value engineering, or economic analysis. (Whole Building Design Guide)

### **Multi Criteria Analysis**

A multi-disciplinary method that uses qualitative as well as quantitative measuring scales to resolve problems with multiple value systems and objectives, which cannot be easily quantified (e.g. environmental issues) or translated in monetary terms due to their intangible nature (e.g. social, cultural or psychological issues). Unlike cost benefit analysis, MCA does not require all factors to be priced in order to be considered.

### **Municipal Solid Waste (MSW)**

Residential solid waste and some non-hazardous commercial, institutional, and industrial wastes. This material is generally sent to municipal landfills for disposal.

### **Naphthalene**

Naphthalene is commonly used in mothballs. Short-term exposure of humans to naphthalene by inhalation, ingestion, and dermal contact is associated with hemolytic anemia, damage to the liver, and neurological damage. EPA has classified naphthalene, possible human carcinogen.

### **Natural Resources**

All the parts of the Earth that are not human-made and which people use, like fish, trees, minerals, lakes, or rivers.

### **Neoclassical Economics**

The currently dominant school of economics, characterized by its marginal utility theory of value, its devotion to the general equilibrium model stated mathematically, its individualism and reliance on the free markets and the invisible hand as the best means of allocating resources, with a consequent downplaying of the role of government.

### **Nitrogen Oxides (NO<sub>x</sub>)**

A group of gases made up of nitrogen and oxygen that generate acid rain and other environmental problems, such as smog and eutrophication of coastal waters. Burning fossil fuels, such as coal and gasoline, releases NO<sub>x</sub> into the atmosphere. Various programs are reducing NO<sub>x</sub> emissions, including the Acid Rain Program and NO<sub>x</sub> cap and trade programs. (US EPA)

### **Nuclear Power**

Energy that comes from breaking apart the center (nucleus) of an atom. (US EPA)

### **Nonrenewable Resource**

Low entropy matter-energy useful to humans and present in fixed stocks whose quantity declines over time. This includes mineral resources, fossil fuels, and fossil aquifers. As fresh water is naturally recycles through the hydrological process, we do not classify it as a nonrenewable resource.

### **Open System**

An open system takes in and gives out both matter and energy. The economy is such a system.

### **Opportunity Cost**

The best alternative given up when a choice is made, i.e., if a farmer cuts down a forest to expand his cropland, and if the consequent loss of timber, firewood, and water purification is the opportunity cost of the expanded cropland.

### **Optimal Scale of the Macroeconomy**

Occurs when the increasing marginal social and environmental costs of further expansion are equal to the declining marginal benefits of the extra production. Beyond the optimal scale growth becomes uneconomic, even if we conventionally refer to the expansion of the economy as "economic growth."

### **Particulate Matter**

Tiny solid particles or liquid droplets suspended in the air.

### **Perfluorocarbons (PFCs)**

A group of human-made chemicals composed of carbon and fluorine only. These chemicals (predominantly CF<sub>4</sub> and C<sub>2</sub>F<sub>6</sub>) were introduced as alternatives, along with hydrofluorocarbons, to the ozone depleting substances. In addition, PFCs are emitted as by-products of industrial processes and are also used in manufacturing. PFCs do not harm the stratospheric ozone layer, but they are powerful greenhouse gases.

### **Persistent Bioaccumulative Toxic (PBT)**

PBT pollutants are chemicals that are toxic, persist in the environment and bioaccumulate in food chains and, thus, pose risks to human health and ecosystems. The biggest concerns about PBTs are that they transfer rather easily among air, water, and land, and span boundaries of programs, geography, and generations.

## **Pollutants**

Chemicals or other substances that are harmful to or unwanted in the environment. Some examples of pollutants are sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), ozone, and particulate matter. (US EPA)

## **Polychlorinated Biphenyls (PCBs)**

PCBs belong to a broad family of man-made organic chemicals known as chlorinated hydrocarbons. PCBs were domestically manufactured from 1929 until their manufacture was banned in 1979. They have a range of toxicity and vary in consistency from thin, light-colored liquids to yellow or black waxy solids. Due to their non-flammability, chemical stability, high boiling point, and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics, and rubber products; in pigments, dyes, and carbonless copy paper; and many other industrial applications.

## **Public Good**

Without financial incentives, the marketplace does not supply essential goods and services such as clean air and water, and ecosystem services. These goods and services are called “public,” rather than “private,” because everyone can use them and often, government action is necessary for their creation or protection.

## **Renewable Resource**

A living resource that is capable of regeneration and growth in perpetuity if exploited in a sustainable manner and that provides raw materials for the economic process.

## **Scale**

The physical size of the economic subsystem relative to the ecosystem that contains and sustains it. It could be measured in its stock dimension of population and inventory or artifacts, or in its flow dimension of throughput required to maintain the stocks.

## **Sink**

The part of the environment that receives the waste flow of the throughput and may, if not overwhelmed, be able to regenerate the waste through biogeochemical cycles back to usable sources.

## **Social Discount Rate**

A rate of conversion of future value to present value that reflects society’s collective ethical judgment, as opposed to an individualistic judgment such as the market rate of interest.



## **Solar Energy**

Radiant energy flowing from the sun, our basic long-run source of low entropy that sustains life and wealth.

## **Subsidy**

A bonus or payment for doing something, the opposite of a tax.

## **Sulfur Dioxide (SO<sub>2</sub>)**

A naturally occurring gas made of sulfur and oxygen that contributes to acid rain. Burning fossil fuels, such as coal, releases SO<sub>2</sub> into the atmosphere. Various EPA programs are reducing SO<sub>2</sub> emissions, including the Acid Rain Program. (US EPA)

## **Sulfuric Acid**

An acid that can be produced in the atmosphere from sulfur dioxide, a pollutant that results from the burning of fossil fuels. (US EPA)

## **Sustainable Scale**

Defined by the Earth's finite limits, in which efficient allocation and just distribution must be maintained, if a stable, steady-state economy is to be attained.

## **Thermodynamics**

### **First Law of Thermodynamics**

Matter's quantity is finite and constant. Its quality is not. Matter changes both in nature, and as it moves through the economic system (this is the 1st Law of Thermodynamics). This means that any interaction we have with the World and the ecosystems that support life, such as waste disposal, must be accounted for, sooner or later.

### **Second Law of Thermodynamics (Entropy)**

As matter moves through nature and the economic system, its intrinsic properties change and it becomes less useful and usable (this is the 2nd Law of Thermodynamics), requiring more and more resources to make them useful, once again. Very useful (low-entropy) goods, such as mineral ore or fuels, eventually produce less useful (high-entropy) matter, such as scrap metals and greenhouse gas, as they move through the economic system.

## **Throughput**

The flow of raw materials and energy from the global ecosystem's sources of low entropy (mines, wells, fisheries, croplands), through the economy, and back to the global ecosystem's sinks for high entropy wastes (atmosphere, oceans, dumps).

## **Toxic**

Toxic is any substance that is capable of harming a person if ingested, inhaled, or absorbed through any body surface. Toxic substances vary widely in the types of harm they cause and the conditions under which they become harmful.

**Toxin**

A toxicant produced by a living organism.

**Urbanization**

The growth of urban areas from rural areas as a result of population immigration to an existing urban area.

**Volatile Organic Compound (VOCs)**

Any organic (carbon-containing) compound that evaporates readily to the atmosphere at room temperature. VOCs contribute significantly to smog production and certain health problems. VOCs often have odors, examples include gasoline, alcohol, and the solvents used in paints.

**Waste Absorption Capacity**

The capacity of an ecosystem to absorb and reconstitute wastes into usable forms through biogeochemical cycles powered by the sun. This capacity is a renewable resource that can be overwhelmed and destroyed, or used within sustainable limits.

**Wastewater**

Used water that contains dissolved or suspended waste materials.

**Wind Power**

Energy that is generated when the wind turns the sails of a windmill, which are attached to turbines that generate electricity. (US EPA)



# interviews

**Christopher Payne**

Lawrence Berkeley National Laboratory

**Matthew Gray**

Office of Energy Efficiency + Renewable Energy, DOE.

**Ernest Fossum and Chris Ischay**

Idaho National Laboratory

**Melanie Berkemeyer**

Department of State, Overseas Buildings

# christopher payne

Lawrence Berkeley National Laboratory (LBNL)

March 27, 2009 via telephone

***What are some of the daily challenges you face in operationalizing sustainability into your workplace?  
In other words, where does the “system” break down?***

One of the primary challenges the Washington, DC office of LBNL faces is making physical changes to the workplace, like installing blinds, repainting walls, and moving partitions. As a tenant in a commercial office space that is sub-leased, the lease agreement precludes these types of modifications. Our office is currently a sub-lease tenant that occupies 1/3 of 1 floor in 10 floor building, so our clout with the building management to request these modifications is minimal.

Another challenge that LBNL faces is in the procurement process. Procurement is typically initiated and filtered through the local office manager. For items that have a relatively high dollar value or inventory value, procurement is then moved to a central purchasing process. Big ticket items require an official procurement requisition. Smaller items can typically be ordered through a more informal process (email).

The procurement dilemma is two-fold. Contracting authorities need more training in appropriate purchasing practices. An additional challenge is there is no effective feedback mechanism. As the procurement official is not typically the person that purchases the good. Typically, the best way to return items is by “grumbling”. The best way to ensure that the right item is ordered is to contact the purchasing person via telephone before it is ordered. It is often very difficult to actually speak to the person, so this method is typically not effective.

Another failure is that in some cases, the policy follows the practice. Christopher shared a great anecdote about implementation of green building practices at a federal facility. At the facility, there has been continuous effort to make office alterations more “green”. The facility managers implemented a requirement of green wall board. After the policy was implemented; the facility managers discovered that all of the contractors were already using green wall board. Since other government agencies had already mandated this, the contractors had started using green wall board on all of their federal work. Christopher mentioned that kind of “spillover” is powerful and happens regularly.

There is an Energy Efficiency Program in place but it is not robust. LBNL, like other federal facilities, operates under multiple energy mandates like the Energy Policy Act of 2005, the Energy Independence and Security Act of 2007, and Executive Order 13423. Despite these mandates, there are few feedback mechanisms to ensure such guidelines are met.

***Where does the system work?***

Some environmental policies are successful. For example, the Defense Logistics Agency instituted a process several years ago of automatic substitution. If someone tries to order paper that doesn't meet the required recycled content, there is automatic substitution of their order for the product that does not meet the requirement. The paper with the required recycled content arrives with a note in the box



explaining why the substitution occurred and what to order in the future. This is very effective with paper, but it tends to be more difficult with items other than paper - cost, design features, and other variances make automatic substitutions problematic.

LBNL, like many federal government agencies, has leveraged their buying power in computers. Laptop computers typically incorporate technology that allows very low energy use by using power management functions. Desktop models had previously not been outfitted with this technology. Executive Order 13221 required that desktop computers be outfitted with the same low-energy technology that laptops are, thus dramatically reducing energy requirements and cost. It was relatively easy for manufacturers to comply. While the success is not easily quantifiable, impact does occur. Similarly, some of the success of the Energy Star Label for buildings can be attributed to the federal sector because of the federal requirement for agencies to lease high-performance buildings.

***Were You Familiar with the concepts of Ecological Economics?***

The theoretical concepts are straightforward and sensible. Ecological Economics is a refinement and complicating theory of neo-classical economics where first cost often receives most of the attention, and Ecological Economics offers a more holistic vision.

Tools of neo-classical economics, such as LCCA, are necessary but often not sufficient. Ecological Economics breaks through theoretical barriers into a logical process for decision makers.

Chris is optimistic for long-term prospects and cited the history of social change. We are recognizing the need to move to transformative economy that values clean energy. However, at this stage we are in a race against time. Are we going to figure it out in time?

***What organizations are you a part of that have helped you become more informed? (Partnerships that have been helpful thus far.)***

Lawrence Berkeley's relationship with federal interagency working groups has been beneficial as has their relationship with the Office of the Federal Environmental Executive. In broad terms, entities that are concerned about the environment and the Federal Government and are doing what they can to move forward are beneficial relationships. These are the groups that are making changes happen and thinking about sustainability broadly. There are other entities that could be obvious partners such as The Associations of Public Procurement Officials. Thus far, there have been mixed responses coming out of the vendor community.

“If someone orders paper that doesn't meet the required recycled content, there is automatic substitution of their order for the product that does meet the requirement.”

*Have you implemented any policies to ensure “green behavior”? (contracts, procurement)*

Successful amendments to the FAR encouraging green behavior have been important. Also, instituting automatic substitutions has been successful, and should be rolled out further.

## Closing thoughts

Christopher believes that continuing the discussion on the “3 legs of the stool” economic, environmental, and social is important. People are starting to see the link between economic and environmental, but are having a tougher time with the social aspect and linking environmental and social is difficult. The new Sustainable Development Guide is trying to strengthen this link. Christopher recommended reading *Blessed Unrest* by Paul Hawken. Christopher also suggested making implementation a focus of the Sustainable Development Guide, as it is one of the greatest problems for green programs. Specifically, a communication section aimed at people who “try to make it easy”.

Understanding the existing process is the key to change. The people, who want to do the right thing, will figure out how to do it. While there are typically work-arounds, the majority of people will go with the flow and do what is easy. Make the right thing: the easy thing to do.

“Understanding the existing process is the key to change. The people, who want to do the right thing, will figure out how to do it.”



# matthew gray

Office of Energy Efficiency and Renewable Energy, DOE

April 9, 2009 via telephone

*What are some of the daily challenges you face in operationalizing sustainability into your workplace? In other words, where does the “system” break down?*

One of the primary challenges that DOE and many other agencies face is properly accounting for all environmental and social considerations in Life Cycle Cost Analysis. Another recent challenge has been getting to DOE sites the level of training on sustainable practices that's requested.

*Where does the system work?*

DOE is pretty successful at leveraging the work of sustainability champions at a number of DOE sites. These champions proactively started their work years ago before there were any sustainability requirements largely because it was just the right thing to do. One of these requirements at DOE is requiring LEED Gold certification for all new construction projects over \$5 million. Implementing a sustainability requirement for existing buildings has been more difficult partly because the tools are still in development.

*Do you have a green program for the workplace, procurement, or services?*

DOE has implemented an electronic stewardship program for 95% of their sites.

Yes, the Department has established green procurement goals and requirements. DOE's Preferred Procurement program requires the purchase of products with the most environmental attributes possible, especially those attributes designated by Congress for purchase—biobased, energy and water efficient, recycled, alternative fuels and vehicles, and non-ozone depleting. The Department also integrates sustainable purchasing into operations through its chemical safety, electronics stewardship and sustainable design programs.

The Department sets policies and requirements at the Headquarters level, but procurement of products is typically controlled at the site level. The Department collects data from each site on an annual basis to track site compliance with its sustainable procurement requirements, and reports annually to OMB and the Federal Environmental Executive.

“DOE requires LEED Gold certification for all new construction projects.”

The Preferred Procurement Program holds a quarterly teleconference to promote sharing of best practices and lessons learned, and to keep purchasers informed of new products and emerging issues.

***What organizations are you a part of that have helped you become more informed?  
(Partnerships that have been helpful thus far.)***

There's many great organizations to go to for more information on sustainability. A couple examples include:

- Key contributors to the Whole Building Design Guide, including the National Institute of Building Sciences and numerous federal agencies.
- Laboratories for the 21st Century (Labs 21) has been a very successful partnership between government and the private sector.

***Have you leveraged technology to support either green behavior or green operations? (building automation systems, automatic light shut-off, conferencing technology)***

DOE buildings are increasingly using the latest green technologies available, but there's still much work to be done. Automation of systems is also increasingly used, which is necessary to complement any behavioral changes.

***Does your agency measure success on the sustainability front? (carbon footprint, specific improvements)***

DOE has been measuring energy usage for over twenty years. Carbon measurement and Greenhouse gases are starting to come to the forefront especially on the campus or site level. Water use is being tracked and water reduction goals have been set. Other key indicators we track include green procurement, the number and quality of LEED certified buildings, and the number of buildings that have been assessed against the High Performance and Sustainable Building Guiding Principles.

***What are other agencies or companies out there that would be interesting to include in this Guide?***

There are many great organizations out there, but here's just a few:

- The Rocky Mountain Institute
- American Institute of Architects
- US Green Building Council
- Sustainable Buildings Industry Council
- IFMA is helpful especially for training of facility managers

***Do you have a "green" training program? How is this rolled out and how often do you offer "refresher" training sessions for existing or new employees?***

We certainly have training programs on many topics related to sustainability, but they probably still don't suffice to meet the demand. This is an area we continuously work to improve, as it is vital for folks in the field to get the training they need. Webinars are used to the extent possible to eliminate travel. Some "Train the Trainer" sessions have also been successful.

# ernest fossum + chris ischay

Idaho National Laboratory (INL)

May 20, 2009 via email

***What are some of the daily challenges you face in operationalizing sustainability into your workplace? In other words, where does the "system" break down?***

We have deeply entrenched project policies to maximize the square footage of new facilities with the available funding. This has an unfortunate side effect of losing many of the more innovative and sustainable opportunities due to value engineering. Energy efficiency and sustainability are still viewed as "extras" that do not contribute to a cost effective project. Although several on the engineering staff have embraced sustainability, it is still viewed as a burden to most.

This viewpoint is slowly changing. We have two recent projects where LEED certification has been desired and specified.

***Where does the system work?***

We have a functioning "Affirmative Procurement Program", which considers the energy and environmental factors of purchases. We also have a basic recycling program with individuals that are proactively engaged in expanding the program.

***Do you have a green program for the workplace, procurement, or services?***

Only the "Affirmative Procurement" and recycling programs.

***What organizations are you a part of that have helped you become more informed? (Partnerships that have been helpful thus far.)***

We actively participate in the EFCOG Energy Efficiency Working Group, which has provided networking and lessons learned on activities from DOE national labs across the complex. This working group has recently been modified to the Energy and Infrastructure Working Group with an Energy and Sustainability Subgroup.

***Have you implemented any policies to ensure "green behavior"? (contracts, procurement)***

The "Affirmative Procurement" program which includes a checklist that requesters must complete prior to submittal, and recycling programs (office, industrial, and chemical). The INL Green Building Strategy is used as a reference document when applying the engineering management system.

***Have you leveraged technology to support either green behavior or green operations? (building automation systems, automatic light shut-off, conferencing technology)***

Yes, we have building automation controls on eight of our significant in-town office and laboratory facilities. We have lighting controls and programmable thermostats on many other facilities. We are beginning a large project to install \$33M of upgrades to one of our desert site locations including lighting upgrades, building control systems, boiler replacements, air compressor replacements, and two solar walls.

We are regularly streamlining our transportation systems. We currently operate a fleet of over 1,600 vehicles, 112 of which are over the road motor coaches for bus transportation. We are developing park and ride opportunities, express bus routes, and reducing low usage routes and shuttle service. We are obtaining new leased buses with increased fuel economy and the ability to run on biodiesel, of which we are testing the use throughout the year, even when our temperatures dip well below zero.

Our fleet contains many flex fuel vehicles and we are updating our fueling infrastructure to accommodate E-85 at as many locations as possible. Our fleet also contains numerous GNG vehicles, seven LNG buses, and three brand new hybrids.

Over 10 years ago, our Industrial Complexes (50 miles west of Idaho Falls) moved to a four day a week, ten hour day schedule to decrease transportation and infrastructure costs. The Idaho Falls Research and Engineering Campus moved to an eighty hours in nine days schedule to decrease infrastructure costs.

***Does your agency measure success on the sustainability front? (carbon footprint, specific improvements)***

We do keep track and report energy usage, which includes GHG estimates from the reporting packages. We do not currently report our carbon footprint, but we are planning to delve into our carbon footprint in the next several months.

***What are some of the more creative or unexpected solutions that came out of the process of greening your workplace? (alternative work, transportation policies)***

We still struggling with obtaining updated bike racks to accommodate increased bicycle usage, so we are a little short on the unexpected solutions. We are getting there though.

***What are other agencies or companies out there that would be interesting to include in this Guide?***

You should include information on the Federal Super ESPC program as well as information on utility UESC programs. These partnerships can be especially useful for agencies that have very little or no liquid financing to pay for upgrades up front.

***Do you have a "green" training program? How is this rolled out and how often do you offer "refresher" training sessions for existing or new employees?***

We do not currently have green training program. We do provide employee awareness information on a quarterly basis to all employees that can be used to assist programs at work as well as at home.

“Our fleet contains many flex fuel vehicles and we are updating our fueling infrastructure to accommodate E-85 at as many locations as possible. Our fleet also contains numerous GNG vehicles, seven LNG buses, and three brand new hybrids.”

# melanie berkemeyer

Department of State, Overseas Buildings Operations

May 19th, 2009 via email.

***What are some of the daily challenges you face in operationalizing sustainability into your workplace? In other words, where does the "system" break down?***

The Green Team at OBO has done a great job of executing sustainability processes into our buildings overseas. However, to be truly successful in this endeavor it's incumbent upon every employee to understand the impact of their actions and what steps they can do in this effort. We're trying to spread the word that every little day-to-day activity such as recycling all cardboard, paper and glass products, using energy only when it's needed, and making carpooling or public transportation a more popular commuting method can make a huge difference. The Green Team can provide the sustainability expertise, but the challenge is to have everyone use that expertise to change their every day behaviors.

***Where does the system work?***

The Green Team has the most influence with outreach through publications that chronicle our activities. Green Team members write articles for State Magazine and other publications to help provide information about what we do and share best practices. In addition, we published the Green Guide for Embassy and Consulate Operations which is used at posts overseas and are launching a new webpage on the Bureau's website. All of this is done with the primary goal of better informing the Department of the work we do in the field of sustainability.

***Do you have a green program for the workplace, procurement, or services?***

The Department, under the direction of Secretary of State Hillary Rodham Clinton, is in the process of establishing a Greening Council as part of a large Greening Diplomacy Initiative. This initiative will work to institute Green policies of this type Department-wide, and will address sustainable issues both overseas and domestically.

***What organizations are you a part of that have helped you become more informed? (Partnerships that have been helpful thus far.)***

The US Green Building Council, Construction Industry Institute, American Institute of Architects, and the Federal Interagency Sustainability Working Group are a few of the organizations that have been a great resource for sharing ideas and implementation strategies.

***Have you implemented any policies to ensure "green behavior"? (contracts, procurement)***

The Green Team has created a Green Guide for Embassy and Consulate Operations which provides suggestions for employees such as Fleet Management and establishing priority parking for ride-share participants. OBO emphasizes green behavior but uses technology to supplement the lack of personal behavior by placing occupancy sensors in the restroom, automatic shut-off faucets, and other energy and water conservation tools.



***Have you leveraged technology to support either green behavior or green operations? (building automation systems, automatic light shut-off, conferencing technology)***

OBO routinely installs waterless urinals, dual-flush toilets, low-e glazing, sun shading devices coupled with light shelves, occupancy sensors for lighting and ventilation, high-efficiency HVAC systems and other state of the art technologies. The Green Team is constantly looking for new technology to support green behavior and green operations. For example, in April of this year OBO installed a magnetic levitation (maglev) chiller in Geneva, Switzerland, the first of its kind in Europe. Tokyo, Japan was a recipient of the maglev technology two years ago.

***Does your agency measure success on the sustainability front? (carbon footprint, specific improvements)***

OBO is very proud of the steps we have taken to track our buildings' cost and utility consumption in order to benchmark our success in compliance with Executive Order 13423. The ultimate goal is to measure the Department of States' overall carbon footprint throughout the entire world.

***What are some of the more creative or unexpected solutions that came out of the process of greening your workplace? (alternative work, transportation policies)***

The Green Guide for Embassy and Consulate Operations was the catalyst for embassies overseas to begin to implement green solutions. Since each location around the world has different challenges, State Department employees found creative ways to implement these suggestions. These creative ideas spurred other offshoots which had a multiplier effect on new ways to reduce our carbon footprint. The Green Team has become a repository for these new and innovative ideas which are constantly being fed to Washington and sent back out to the field and shared as best practices. For example, at one embassy an innovative employee wrote a computer program that shut down all desk-top computers at night and started them again an hour before the work day commenced, saving hundreds of thousands of dollars in saved electricity costs.

***What are other agencies or companies out there that would be interesting to include in this Guide?***

The US Postal Service appears to be very green in some of their policies, and manages the nation's largest civilian fleet—they might have some lessons to share.

***Do you have a "green" training program? How is this rolled out and how often do you offer "refresher" training sessions for existing or new employees?***

OBO typically enlists outside consultants to provide LEED training for accreditation. Additionally, the Department provides training tailored to various Foreign Service Officers, so that they may understand the issues, context, urgency, and application specific to the buildings they work in, operate, and manage.

**“The Green Team can provide the sustainability expertise, but the challenge is to have everyone use that expertise to change their every day behaviors.”**





GSA Office of Governmentwide Policy  
Office of Real Property Management

U.S. General Services Administration  
1800 F Street, NW  
Washington, DC 20405  
[www.gsa.gov](http://www.gsa.gov)