

GREEN FACILITIES

Green facilities are smart facilities. They are businesses that control their costs through focused attention on reduced energy consumption, enhanced equipment efficiency, consistent maintenance, and more flexible building and human resource management. In the sense that business environmental sustainability is largely measured in resource efficiency, businesses have been practicing sustainability for a long time under the name of *cost reduction*. A business that did not routinely look for ways to produce their products or services less expensively was destined to be overtaken by producers who operated more efficiently and sold their wares for less. This aspect of green practices is not new, though the tools available to today's managers for assessing and implementing cost reduction measures are vastly greater than those of even a decade ago. What is new, and what this book addresses, is the beginning of a new era of looking at a wider range of sustainability factors—including facilities, human resources, equipment, and operations—in a comprehensive manner as part of an overall sustainability program. The new reality of sustainable management means assessing the effects of facility and equipment changes on employee productivity, production efficiency, energy consumption, and a host of other interrelated factors:

- How does implementing an employee ride-share program affect employee working hours, productivity, and building operation costs?
- Can the use of compressed air be reduced without losing productivity, and is it worth the cost?
- Does a redesign of the steam supply system for greater efficiency allow for cost-effective expansion when orders increase?
- How does allowing employees to open windows during temperate periods affect absenteeism and liability associated with asthma sufferers?

Managing in the green era requires broader vision, more thoughtful analysis, and a healthy dose of prognostication. Sustainable management is part analytical and part intuitive, a blend of business benefits and greater good. Most of all, sustainability is now an established movement with public and employee support. Creating greener

facilities is a necessity for managers, and they would do well to follow the advice of Francis Bacon: “Things alter for the worse spontaneously, if they be not altered for the better designedly.”

What Is Sustainability?

The most common definition of sustainability is that adopted by the Brundtland Commission of the United Nations in March 1987: “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” This very broad definition is helpful to governments and the public, but provides little guidance to business or facility managers. The Council of Smaller Enterprises (COSE) offers a crisper definition in their mission statement: “Sustaining and supporting the small business community through improved economic, environmental, and community design strategies leading to increased implementation of energy conservation, recycling, and employee wellness programs.”¹

The Benefits of Sustainability

The greening of global business has, in some ways, occurred with surprising speed. Long-time backers of environmental movements would certainly disagree, citing the origins of their movement in the 1960s and the long, difficult road to persuading American consumers and businesses that recycled products have high quality and marketability. What has occurred in the last decade, however, has been a widespread embracing of sustainability benefits by global consumers. While the American public is the newcomer to this party (European consumers having embraced green concepts long ago), they have done so with gusto. A 2008 Gallup Poll revealed that 72 percent of Americans avoided using products that harm the environment, with 86 percent of Americans stating that they are currently recycling household waste such as newsprint and glass.² Sustainability may no longer represent a marketing advantage so much as a consumer expectation.

Companies that have embarked on sustainability audits, either limited or comprehensive, report improvements both in public perception and in their bottom line. While the need to at least appear green has prompted a fair amount of “greenwashing” (false or unproven sustainability claims), responsible corporations have embraced sustainability as a way to improve their overall operations and facility competitiveness. Among them:

- Gundersen Lutheran Hospital of La Crosse, Wisconsin, conducted an audit of their facilities to look for improvements that could be implemented quickly, said Jerry Arndt, Senior Vice President of Business Services. “The most responsible thing you can do is reduce the amount of energy you need,” Arndt said. “So we looked in-house for improvements before we looked at renewables.” Among other items, Gunderson found their facility included 300 exhaust fans that were running full time

and could be shut off for 12 hours each day. Another part of their audit determined that 60 percent of the hospital's energy expenses were incurred for steam production. As a result, the hospital began a program of replacing and repairing steam traps to improve efficiency.³

- Proctor and Gamble's energy-efficiency program reduced water consumption by 52 percent, energy usage by 48 percent, CO₂ emissions by 52 percent, and waste disposal by 53 percent in their production facilities.⁴
- In 2004, Timberland began energy-efficiency improvements that resulted in savings of over 40 percent in energy and emissions at the company's largest facilities. In 2006, they began using solar photovoltaic (PV) arrays at their Ontario, California, Distribution Center. That facility is now 60 percent powered by their PV system.⁵
- Walmart has committed to eliminating landfill waste at their stores and Sam's Club facilities by 2025. Between February 2008 and January 2009, they reduced landfill waste from their stores by more than 57 percent. The company has established three clear, ambitious green goals⁶:
 - 1 Being supplied 100 percent by renewable energy,
 - 2 Creating zero waste, and
 - 3 Selling products that sustain people and resources.

All of these companies, in ways ranging from limited to expansive, have employed green practices to benefit their image and competitiveness. Panelists at the 2009 West End Business Improvement Association Sustainability Expo in Vancouver, BC, agreed on five key factors that are driving businesses to become more sustainable⁷:

- Consumer demand
- Competition and branding
- Cost savings
- Current employee morale and new employee demands
- Regulations

Sustainability simply makes good business sense. Managing facilities in a sustainable manner means that, especially in times of economic uncertainty, a company is working to reduce costs and achieve operating efficiencies. Along with whatever marketing or public image benefits it derives from green practices, businesses also achieve competitive advantage and sustained growth from the benefits of using less energy and producing goods more efficiently. See Fig. 1.1 for a summary of potential benefits of adopting sustainable practices in commercial facilities.

This is a reality already recognized by a high percentage of companies. A survey of U.S. companies showed an increasing trend toward adopting sustainable principles in workplace management⁸:

- 58 percent of U.S. employers surveyed have formal green workplace programs
- 85 percent use webinars or teleconferencing
- 78 percent have green communication programs to reduce paper usage
- 72 percent use online human resources communications



- Reduced material costs
- Reduced waste costs
- Reduced energy costs
- Marketing advantages
- Product branding benefits
- Better employee morale
- Enhanced competitiveness

Figure 1.1 Potential benefits of sustainability.

- 58 percent have internal communication programs that offer employees green tips
- 57 percent use online sustainability plan summaries
- 57 percent offer telecommuting
- 52 percent offer a ride-share program

Sustainability in commercial and industrial facilities begins with efficiency. Efficiency is an inexpensive form of renewable energy, generating a higher return on investment than any other improvement. Reducing overall utility usage and waste, diverting waste from landfills to recyclers, utilizing more electronic communication in lieu of paper, and providing healthier work environments for employees are a few of the most common methods that companies employ to improve efficiency and reduce costs. Efficiency is also an ideal way to include employees and consultants in the process of achieving energy and cost savings. Many companies have found their employees will enthusiastically participate in green reward programs that offer recognition and a small financial inducement for identifying workplace economy measures.

The ICC and Sustainability

The International Code Council (ICC) is the preeminent code authority in the country, dedicated to creating model codes that promote building safety, fire prevention, and energy efficiency for residential and commercial buildings. ICC codes are in use, to varying extents, in all fifty states and are used as the basis for the codes of several other countries. The ICC, in partnership with the American Institute of Architects (AIA), the U.S. Green Building Council (USGBC), and three other organizations, has developed the International Green Construction Code (IgCC) slated for release in early 2012. This initiative includes collaboration among a wide range of professional, trade, and green building leaders, as well as outreach and feedback from the general public. The resulting code will cover all aspects of sustainability in the built environment, including drawing from existing codes and standards, to create a single universal code. The IgCC will apply to new construction and renovations, will link in closely with existing American Society of Testing & Materials (ASTM International) standards, and will provide a regulatory framework to assist municipalities and code officials in understanding and administering green construction.

GOALS OF THE IgCC

The goal of the IgCC is to decrease energy usage and carbon footprints along with addressing several other issues:

- The code addresses site development and land use, including preservation of natural and material resources as part of the process.
- Enforcement of the code will improve indoor air quality and support the use of energy-efficient appliances, renewable energy systems, water resource conservation, rainwater collection and distribution systems, and the recovery of used water (also known as gray water).
- The IgCC emphasizes building performance, including requirements for building system performance verification and building owner education to ensure that the best energy-efficient practices are being carried out.
- A key feature of the new code is a section devoted to “jurisdictional electives,” which will allow customization of the code beyond its baseline provisions to address local priorities and conditions.

Additional information regarding the IgCC is available at <http://www.iccsafe.org/>. See Table 1.1 for a list of IgCC sustainable code categories.

SUSTAINABLE ATTRIBUTES VERIFICATION AND EVALUATION™ (SAVE™) PROGRAM

The ICC subsidiary, the ICC Evaluation Service (ICC-ES), has created the ICC-ES SAVE™ Program to verify manufacturers’ claims regarding the sustainable characteristics of their products. One of the biggest problems arising out of the popularity of sustainable construction is the practice of greenwashing, or making environmental sustainability claims for a product that cannot be documented or are patently false. The purpose of the SAVE™ program is to give manufacturers the opportunity to voluntarily document the sustainable attributes of their products. Once approved by ICC-ES, this



TABLE 1.1 IgCC KEY CATEGORIES
<ul style="list-style-type: none"> ■ Natural resource conservation and responsible land use and development ■ Material resource conservation and efficiency ■ Energy conservation, efficiency, and earth atmospheric quality ■ Water resource conservation and efficiency ■ Indoor Environmental Quality (IEQ) and comfort ■ Building operation, maintenance, and owner education ■ Existing buildings

**TABLE 1.2 SAVE EVALUATION GUIDELINES**

EG101 —Evaluation guideline for determination of recycled content of materials
EG102 —Evaluation guideline for determination of biobased material content
EG103 —Evaluation guideline for determination of solar reflectance, thermal emittance, and solar reflective index of roof covering materials
EG104 —Evaluation guideline for determination of regionally extracted, harvested, or manufactured materials or products
EG105 —Evaluation guideline for determination of volatile organic compound (VOC) content and emissions of adhesives and sealants
EG106 —Evaluation guideline for determination of VOC content and emissions of paints and coatings
EG107 —Evaluation guideline for determination of VOC content and emissions of floor covering products
EG108 —Evaluation guideline for determination of formaldehyde emissions of composite wood and engineered wood products
EG109 —Evaluation guideline for determination of certified wood and certified wood content in products

documentation can help those seeking to qualify for points under major green rating systems, LEED or Green Globes program. See Table 1.2 for a list of SAVE program evaluation guidelines.

LEED Certification

Leadership in Energy and Environmental Design (LEED)[®] is a third-party certification program and a widely accepted benchmark for the design, construction, and operation of sustainable buildings. Developed by the USGBC in 1998 through a committee process involving a wide range of nonprofit, industry, and governmental groups, LEED serves as a design and construction template for sustainable buildings of all types and sizes. As of 2009, USGBC estimated that more than 4.5 billion square feet (4.18 billion square meters) of building area has been designed under the LEED program.

The certification process, administered by a USGBC spin-off organization called the Green Building Certification Institute (GBCI), determines the appropriateness of buildings for LEED certification through an online submission process, using templates for each of the seven types of construction recognized under the LEED system. LEED certification is available for the following building types: general new construction, major renovation, existing buildings, commercial interiors, core and shell, schools, and homes. As of this writing, LEED certifications for retail space, neighborhood development, and healthcare facilities are currently in development.

LEED NEW CONSTRUCTION

LEED New Construction (LEED NC) is the category most often used by businesses for LEED certification. This category covers, as the name implies, almost all new construction work (see the core and shell exception below), and major renovation work as well. According to USGBC, “A major renovation involves major HVAC renovation, significant envelope modifications, and major interior rehabilitation.” In cases with lesser degrees of renovation not meeting the criteria for LEED NC, owners and contractors should use the LEED for Existing Buildings: Operation and Maintenance criteria (LEED EB).

To qualify for certification, projects must meet certain prerequisites and earn additional performance points in six base categories of sustainable design. The six categories are:

- Sustainable Sites (SS)
- Water Efficiency (WE)
- Energy and Atmosphere (EA)
- Materials and Resources (MR)
- Indoor Environmental Quality (IEQ)
- Regional Priority (RP)

An additional category, Innovation in Design (ID), addresses unusual or exceptional situations, as well as design situations not covered under the six environmental categories. See Table 1.3 for a summary of the points and prerequisites associated with each category.



TABLE 1.3 LEED NC CATEGORIES

- Sustainable Sites: 26 possible points
 - Prerequisite 1: Construction activity pollution prevention
- Water Efficiency: 10 possible points
 - Prerequisite 1: Water use reduction
- Energy and Atmosphere: 35 possible points
 - Prerequisite 1: Fundamental commissioning of building energy systems
 - Prerequisite 2: Minimum energy performance
 - Prerequisite 3: Fundamental refrigerant management
- Materials and Resources: 14 possible points
 - Prerequisite 1: Storage and collection of recyclables
- Indoor Environmental Quality: 15 possible points
 - Prerequisite 1: Minimum indoor air quality performance
 - Prerequisite 2: Environmental Tobacco Smoke (ETS) control
- Innovation in Design: 6 possible points
- Regional Priority: 4 possible points

LEED projects can earn up to 100 base points, plus an additional six Innovation and Design Process credits and up to four Regional Priority points for obtaining products within a 500-mile (805-kilometer) radius of the construction site. Projects are recognized in four progressive categories, according to the number of points they earn:

- Certified Project: 40–49 points
- Silver Project: 50–59 points
- Gold Project: 60–79 points
- Platinum Project: 80 points and above

The USGBC New Construction (NC) standards may apply to new buildings or to renovation projects where a significant portion of the facility is undergoing renovation. The LEED program does make a distinction, however, regarding projects that are designed and constructed to be partially occupied by the owner or developer, with the rest being occupied by tenants. In these projects, USGBC claims that the owner or developer has direct influence over the self-occupied portion of the building. To pursue certification under the LEED NC category, the owner must therefore occupy 50 percent or more of the building's leasable area. Where this is not the case, the project is not suitable for LEED NC credits and the owner should pursue LEED for Core & Shell certification.

Total LEED program-related costs vary with the project type and size. Registration of a project with GBCI costs approximately \$450 (for USGBC members) and \$600 (for non-members). LEED certification costs vary with project size, but the USGBC states that the average cost is around \$2,000. Indirect costs may include independent LEED consultants and building commissioning. These costs vary dramatically based on the size and complexity of the project.

DOCUMENTATION REQUIREMENTS

LEED certification requires extensive documentation to prove that the project was completed in accordance with the requirements. LEED provides customized online templates (fillable forms) for LEED-accredited professionals to use for documenting each prerequisite and credit. Additional documentation is sometimes required beyond the information presented on the form, and the level of documentation can be rather extensive. The documentation for recycled content and regional materials, for instance, can require obtaining information from numerous outside suppliers for projects with multiple components from different sources.

Because the contractor is responsible for construction waste management, businesses will need to rely on him for documenting compliance with this prerequisite. This will require the contractor to tabulate the total waste material, quantities diverted from landfills, and the means through which they were diverted.

A portion of the credits in each application will be audited, and the company should be prepared with backup documentation for any credit claimed, whether required as part of the initial application or not. Certification is now administered by the GBCI

through a network of professional, third-party certification bodies. To register a project for LEED certification, visit www.gbci.org.

LEED FOR EXISTING BUILDINGS

The LEED EB rating system states that it “helps building owners and managers measure operations, improvements, and maintenance on a consistent scale, with the goal of maximizing operational efficiency while minimizing environmental impacts.” LEED EB includes criteria for whole-building cleaning and maintenance activities, including recycling programs, chemical use, exterior maintenance programs, and building systems improvements. The LEED EB criteria are intended to apply both to existing buildings seeking LEED certification for the first time as well as to projects previously certified under LEED for New Construction, Schools, or Core and Shell criteria. The LEED EB category requires that a number of requirements be met prior to application for certification. See Table 1.4 for a listing of the Existing Building category pre-application requirements.

The heart of the LEED EB criteria is an operations and maintenance (O&M) guide provided as a managerial tool to assist businesses in monitoring the ongoing operations and maintenance of existing commercial and institutional buildings. LEED EB uses this guide as a tool to identify and reward building O&M best practices. It is also intended as a useful template for businesses in identifying opportunities to reduce energy and utility consumption, improve their indoor environment, and identify and correct operating inefficiencies. The rating system is targeted at single buildings and requires three months of operational data prior to the initial application. Buildings must be in operation for twelve months prior to certification. The O&M template is intended to address whole-building performance as opposed to that of individual tenant spaces. Any building construction or renovation must be complete at least three months before LEED EB certification can be requested. See Table 1.5 for a list of LEED EB certification major compliance categories.

GBCI offers the following tips for managers seeking LEED certification:

- 1 Review the LEED rating system to assess how many credits are possible.
- 2 Choose a target LEED certification level: Certified, Silver, Gold, or Platinum.



TABLE 1.4 LEED EXISTING BUILDING CERTIFICATION PREAPPLICATION REQUIREMENTS

- The building must be at least 75% occupied for 12 months preceding application.
- For residential facilities such as hotels, apartments, or condominiums, average occupancy over the preceding 12 months cannot be less than 75% of the total floor area.
- The project scope must include 100% of the total floor area.
- The building must comply with all local, state, and federal environmental laws.


TABLE 1.5 LEED EXISTING BUILDINGS MAJOR CATEGORY SUMMARY

Refer to www.usgbc.org to purchase the full document

Sustainable Sites (9 points)

- Exterior and hardscape management
- Pest, landscape, and erosion management
- Protect or restore open space
- Alternative transportation
- Roof and nonroof heat island reduction
- Light pollution reduction

Water Efficiency (4–10 possible points)

- Water performance measurement
- Fixture and fitting efficiency
- Water efficient landscaping
- Cooling tower management

Energy & Atmosphere (13–30 possible points)

- Energy efficiency performance
- Refrigeration management
- Building commissioning
- Performance measurement
- Renewable energy
- Emissions reduction

Materials & Resources (9–14 possible points)

- Solid waste management
- Purchasing and ongoing consumables
- Durable goods
- Facility renovations and alterations

Indoor Environmental Quality (16–20 possible points)

- Air intake and exhaust systems
- Tobacco smoke control
- Green cleaning practices
- Indoor air quality best management practices
- Occupant comfort factors (lighting, thermal, and views)
- Pest management practices

Innovation in Operations (4–7 possible points)

- Innovative operations
- LEED accredited professional
- Documenting sustainable building cost impacts

- 3** Assess what equipment will require upgrades.
- 4** Assign company personnel responsibility for achieving the credits and for preparing green policies.
- 5** Prepare a budget.
- 6** Prepare a schedule and project management plan.
- 7** Register the project through GBCI and use resources available online.

LEED LIMITATIONS

As businesses grow more sophisticated regarding sustainable practices, there are questions as to whether LEED is the best vehicle for facility managers to use in measuring their progress or seeking certification for their achievements. Architect and sustainable design educator Warren Wagner has summarized LEED as “minimum requirements at minimum investment.” Many buildings can qualify for LEED in ways that are relatively cheap and easy, neglecting the overall goal of significantly reducing the building’s impact. Wagner also does not believe that the LEED program is ambitious enough to push the industry toward meeting the ambitious 2030 Challenge established by the AIA and other international organizations of architects in 2006. This initiative calls for all new buildings and major renovations to reduce greenhouse gas emissions by 50 percent by 2010 and become carbon neutral by 2030.

LEED also does not address high-performance issues of durability, weather, or fire resistance. As a result, a LEED-compliant building may not be as economical or sustainable in terms of life-cycle costs as buildings that do not meet the LEED requirements.⁹

Other Sustainability Programs

Although the USGBCs LEED program is the most well known, other programs have been developed by national organizations to promote sustainable construction. These programs, some of which include certification components, incorporate aspects of recycling construction and demolition waste to varying extents.

GREEN GLOBES

The Green Globes program is a voluntary certification program administered by the Green Building Initiative, a broad-based consortium of industry, government, and non-profit representatives who modified an early Canadian program into an online resource that is promoted as a more streamlined and interactive alternative to LEED. Green Globes’ focus on modeling energy-efficiency after occupancy is also favored over a sometimes burdensome commissioning system imposed by LEED requirements.

U.S. ENVIRONMENTAL PROTECTION AGENCY ENERGY STAR PROGRAM

The Energy Star program developed by the U.S. Environmental Protection Agency (EPA) is a national energy performance rating system that benchmarks the energy performance of a wide range of commercial facilities relative to the performance of similar facilities across the United States. To be eligible to receive a rating from the Energy Star program, at least 50 percent of a building’s floor area must be defined by one of the eligible space types, which assigns the building to a peer group against which the facility will be compared. Based on their space type, geographical location, and level

of business activity, the program assigns each facility a national energy performance rating on a scale of 1 to 100. Facilities that meet certain criteria and achieve a rating of 75 or better are eligible to apply for an Energy Star designation.

Studies by the EPA show that the more than 3,200 buildings nationwide that have earned the Energy Star rating use about 35 percent less energy than comparable buildings.

NATIONAL INSTITUTE OF BUILDING SCIENCES WHOLE BUILDING DESIGN GUIDE

The Whole Building Design Guide (WBDG) is a diverse collection of sustainable building resources openly available on the Internet at www.wbdg.org. The WBDG provides links to numerous other Internet resources dealing with practically every aspect of building construction and operation.

Payback and Return on Investment

Green savings are commonly expressed as either a payback period or return on investment (ROI). Either form is acceptable as long as the underlying assumptions are correct. ROI is the more commonly accepted method of evaluating business investments, and perhaps the more useful indicator since it translates directly onto the balance sheet. Payback period (represented in months or years until the cost of an energy-efficiency investment is recovered) is generally unimpressive in business terms, both conceptually and numerically. A two-year payback period certainly sounds less desirable than a 50 percent annual ROI. Moreover, it is not really beneficial in assessing the worthiness of an investment. The ROI may be expressed in one of the following four forms:

Simple Payback Period (PP): This is the most basic means of quickly assessing a proposed improvement's value and is normally used for residential or small-scale improvements. PP is represented as time in years necessary to recover the improvement cost. It is calculated as follows:

$$PP = \text{Cost of Improvement} / \text{Annual Savings}$$

Simple ROI: This is a simple form of assessing ROI since it does not consider factors like time value of money, cost of financing, or inflation. This is the method used by many of the online calculators created for various types of projects. ROI is represented as an annual percentage return. It is calculated as follows:

$$ROI = (\text{Gain from Improvement} - \text{Cost of Improvement}) / \text{Cost of Improvement}$$

Net Present Value (NPV): NPV is calculated by adding together the monetary benefits of an energy-efficiency measure over a period of its estimated life and subtracting the costs there from. NPV is a better means than the internal rate of return (IRR) for comparing a number of alternative energy-efficiency improvements against one another. If $NPV > 0$, the project should be considered. If $NPV = 0$, the project will neither gain nor lose money for the business. If $NPV < 0$, the project should be rejected, unless there are human resources or other factors that make it beneficial for the business.

Internal Rate of Return (IRR): This value is useful as a comparison against the rates of return or interest rates of alternative monetary investments available to the business, including stocks and bonds. Energy costs are normally tax deductible for businesses, so the IRR should be compared against the after-tax rate of return for taxable investments. Benefits and costs must be discounted in an IRR calculation to account for the time value of money (or the ability to earn interest or appreciation on an investment).

Calculating NPV or IRR for energy-efficiency improvements requires the following information and assumptions:

- Calculate the initial cost of the improvement (\$).
- Assumed life of the improvement (years).
- Estimate of first-year energy savings (\$).
- Estimate of the annual increase in energy cost (% per year).
- Additional or reduced operating cost resulting from improvement (\$ per year).
- Assumed operating cost inflation factor (% per year).
- Cost of financing the improvement (% per year).

Refer to McGraw-Hill's online resources of this book for NPV and IRR calculators. Online NPV and IRR calculators can also be found at <http://www.energytools.com/calc/EnerEcon.html>.¹⁰

The *ROI Quik-Calc* boxes included in this book are provided as a quick and rough tool for managers to use in making initial assessments about the benefits of various facility improvements. They should be considered a starting point only, a predecessor to a more detailed and project-specific cost and benefit analysis. See Fig. 1.2 for a summary of the methods of assessing ROI.

There is one significant caveat to using these calculations as a sole means to assess green initiatives. The benefits of some sustainability proposals cannot be easily measured in financial terms. Employee retention and loyalty resulting from improved indoor air quality or a company carpool/ride-share program, for instance, can be of substantial value to a company even though it is difficult to quantify that value. Conversely, HVAC modifications that shorten operating hours or adjust set points may yield significant savings but they may also generate employee dissatisfaction and reduce productivity. Managers must weigh tangible and intangible factors in assessing which sustainability measures to implement in their facilities.

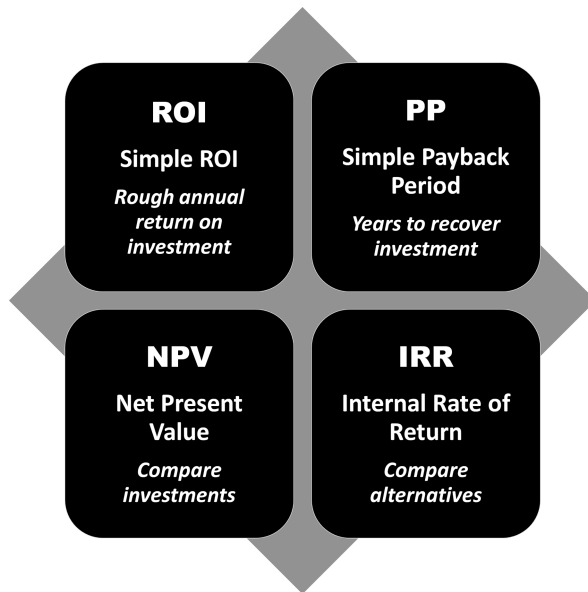


Figure 1.2 Methods of assessing return on investment (ROI).

Energy Calculators and Software

There is no shortage of online calculators, offered by government and industry, to assess the savings associated with energy-efficient improvements. These calculators typically offer basic dollar per year savings for standard improvements, and can be useful to a manager in making a preliminary assessment as to whether a particular type of improvement is worth examining in greater detail. The calculators are most appropriate for office improvements (lighting, plumbing, standard HVAC), and some can help assess construction waste recycling savings or office waste reduction plans. All calculators should be used for initial assessment purposes only, as a way to identify the most promising strategies for a particular site. They should be followed up with detailed estimates based on each facility's specific costs and requirements. See Chap. 8 for a more extensive list of software. See Table 1.6 for a list of major government and organizational sources of sustainability calculators and other tools.

DOE's Office of Energy Efficiency and Renewable Energy It provides calculators and tools aimed largely at the residential market, but they can be useful for multi-family landlords or small businesses in assessing insulation upgrades. <http://www1.eere.energy.gov/consumer/calculators/homes.html>



TABLE 1.6 MAJOR GOVERNMENT AND ORGANIZATION SOURCES FOR SUSTAINABILITY TOOLS

U.S. Department of Energy (DOE) www.energy.gov
U.S. DOE Energy Efficiency and Renewable Energy Department (EERE) www.eere.energy.gov
U.S. DOE EERE Federal Energy Management Program www1.eere.energy.gov/femp
U.S. DOE EERE Industrial Technologies Program www1.eere.energy.gov/industry
U.S. DOE Energy Information Administration www.eia.doe.gov/pages
U.S. DOE Office of Environmental Management www.em.doe.gov
U.S. Environmental Protection Agency www.epa.gov
National Institute of Building Sciences Whole Building Design Guide www.wbdg.org
Athena Institute www.athenasmi.org
Envirolink www.envirolink.org
Healthy Building Network www.healthybuilding.net
U.S. Green Building Council www.usgbc.org

WaterSense calculator The EPA has created a calculator to estimate the savings resulting from installing WaterSense-labeled fixtures and fittings. <http://www.epa.gov/watersense/calculator/index.htm>

Construction waste estimator Peaks to Prairies' Pollution Prevention Information Center, funded by the EPA Region 8, provides a tool that can be used to estimate how much waste will be created during a construction project and the disposal costs required to dispose of this waste, enabling a company to evaluate its potential for reduction, reuse, or recycling of construction waste. <http://peakstoprairies.org/p2bande/construction/C%26DWaste/calculate.cfm>

EPA's WasteWise program tools WasteWise is an EPA program that helps its partners meet goals to reduce and recycle municipal solid waste and selected industrial

wastes. Businesses of all sizes and from all industry sectors can join WasteWise. It provides several tools, described below, to help them in their waste reduction efforts. <http://www.epa.gov/epawaste/partnerships/wastewise/index.htm>.

Measuring Your Progress It is a template that can be used by a business to assess its green program achievements. It provides guidelines and resources for locating data sources, calculating waste reduction results, and determining the environmental and economic benefits of a particular program. <http://wastewise.tms.icfi.com/measure.htm>.

The Waste Reduction and Buy Recycled Tracking Sheet It allows businesses to track their waste prevention efforts, recycling, and purchase of recycled products for one year. It includes five worksheets: Waste Material, Waste Prevention, Recycling, Buy Recycled, and Summary. Companies evaluate their program by comparing this information to baseline data or results from the previous year. <http://wastewise.tms.icfi.com/measure/tracking.htm>.

The Measure of Success—Calculating Waste Reduction Booklet The booklet covers the benefits of measuring waste reduction. It provides step-by-step instructions on how to establish or improve a business waste measurement system and explains a variety of options for different levels of effort and expense. <http://epa.gov/epawaste/partnerships/wastewise/pubs/wwupda11.pdf>.

U.S. Department of Energy Vehicle Calculator The U.S. DOE Office of Energy Efficiency and Renewable Energy's vehicle calculator helps calculate the potential savings from converting to a more fuel-efficient vehicle. <http://www1.eere.energy.gov/consumer/calculators/vehicles.html>.

Waste Reduction Model (WARM) EPA created the WASTE Reduction Model (WARM) to help solid waste planners and organizations track and report reductions in greenhouse gas emissions as a result of different waste management practices. WARM calculates greenhouse gas emissions of baseline and alternative waste management practices, including source reduction, recycling, combustion, composting, and landfilling. WARM is available both as a Web-based calculator: http://epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html and as a Microsoft Excel spreadsheet: <http://epa.gov/climatechange/wycd/waste/calculators/downloads/WARM.zip> http://epa.gov/climatechange/wycd/waste/calculators/Warm_home.html.

PURCHASING AND PROCUREMENT

U.S. EPA purchasing calculator The purchasing calculator: http://www.energystar.gov/index.cfm?c=bulk_purchasing.bus_purchasing is a tool designed to assist businesses in making smarter purchasing decisions. Categories include residential, commercial, consumer, and office products.

Xerox office equipment calculator For a Xerox sustainability calculator for printers and office copiers, visit <http://www.consulting.xerox.com/flash/thoughtleaders/suscalc/xeroxCalc.html>

Endnotes

1. Stika, Nicole. Council of Smaller Enterprises. "Sustainability/Green Plus." <http://www.cose.org/Member%20Benefits/Business%20Savings/Energy%20Solutions/Sustainability.aspx>. Accessed February 18, 2010.
2. Rheault, Magali. Gallup.com. "In Top Polluting Nations, Efforts to Live 'Green' Vary." <http://www.gallup.com/poll/106648/top-polluting-nations-efforts-live-green-vary.aspx>. Accessed March 7, 2010.
3. Environmental Leader. "For Hospitals, Some Sustainability Changes Pay Off in 2 Years." <http://www.environmentalleader.com/2009/07/28/for-hospitals-some-sustainability-changes-pay-off-in-2-years/>. Accessed January 10, 2010.
4. Albinson, Tim. Sourcing Innovation. "A Lesson from the Leaders: Sustainability is the Key to Savings." <http://blog.sourcinginnovation.com/2009/11/23/a-lesson-from-the-leaders-sustainability-is-the-key-to-savings.aspx?ref=rss>. Accessed February 18, 2010.
5. Timberland.com. "CSR-Environmental Stewardship." http://www.timberland.com/corp/index.jsp?page=csr_climate_impact. Accessed January 10, 2010.
6. Walmart.com. "Fact Sheets." <http://walmartstores.com/pressroom/factsheets/>. Accessed January 10, 2010.
7. Green, Cindy. The Green Pages. "Small Business Sustainability: It Can Be Done." http://thegreenpages.ca/portal/bc/2008/07/small_business_sustainability.html. Accessed January 11, 2010.
8. Society for Human Resource Management. "Green Company Programs Increase in U.S." <http://www.shrm.org/Publications/HRNews/Pages/GreenProgramsIncrease.aspx>. Accessed January 12, 2010.
9. Triple Pundit (Environmental News Network). "Is LEED green enough? Conversations from Dwell on Design LA 2008." <http://www.enn.com/lifestyle/article/37354>. Accessed January 10, 2010.
10. Energy Tools.com. "Economics of Energy Efficiency." <http://www.energytools.com/calc/EnerEcon.html>. Accessed March 7, 2010.

