NATURAL CAPITALISM SOLUTIONS
P.O. BOX 398 ELDORADO SPRINGS, CO 80025
WWW.NATCAPSOLUTIONS.ORG

Chapter 5: Local Action Plan Best Bets **Municipal Buildings**

DOCUMENT CONTENTS

Retrofit City Buildings

Buildings are responsible for 50% of greenhouse gas emissions. Reducing the amount of energy used in municipal buildings contribute significantly to a city's greenhouse gas reduction targets. It can also save an enormous amount of money. Retrofitting a building means making changes or additions to a building that has already been constructed. Energy efficiency retrofits can be performed on any existing building, including city offices, libraries, police stations, fire stations, or any other structure owned by the municipality that uses electricity or heating fuels like natural gas.

Although the up-front cost of energy efficient technologies is often higher than their conventional counterparts, the energy efficient options save money in reduced monthly electricity bills. Many efficiency measures pay back in months, and go on to save enough to pay for themselves many times over in the course of their lifetime. Some, such as more efficient light bulbs will pay for themselves out of saved labor costs, because they last so much longer.

Energy efficiency retrofits of buildings include but are not limited to replacing old lighting with high efficiency lighting, replacing old appliances and equipment with ENERGY STAR® equivalents (www.energystar.gov), upgrading the HVAC system, adding insulation and window-shading, eliminating air leaks from doors and windows, and using automated systems like room occupancy sensors.

Lighting Retrofits

Compact Fluorescent Light Bulbs

Compact fluorescent light bulbs (CFLs) use one-quarter to one-third as much electricity as incandescent bulbs and last up to ten times as long. Replacing a 100-watt incandescent with a 32-watt CFL can result in energy savings of as much as $30 over the bulb's life. They also produce less heat so installing

them can reduce air conditioning loads. Their superior quality light can increase worker productivity and reduce error rates.[1]

ENERGY STAR®-qualified CFLs[2] provide the same amount of light as standard incandescent bulbs. CFLs also reduce the risk of burns and fires associated with the use of halogen bulbs that can reach temperatures of 1,000 degrees Fahrenheit.

T8 Flourescent Lamps with Electronic Ballasts vs. T12 with Magnetic Ballasts

All fluorescent lamps utilize bulbs and ballasts. One can replace both parts with more energy-efficient technologies. By replacing standard magnetic ballasts and T-12 fluorescent lamps with more efficient T-8 lamps and electronic ballasts, a building can consume 40% less energy for lighting.

The standard commercial lighting with the 1.5-inch diameter (T-12) cool-white fluorescent lamps and transformer-type magnetic ballasts is quickly becoming an obsolete technology. The combination of high-efficiency 1-inch (T-8) lamps coupled with electronic ballasts can reduce total energy use for lighting significantly. The light produced by the new systems more closely resembles natural light. The new technology also eliminates the rapid flicker and the faint buzz of traditional fluorescent lights. For each fixture of four lamps that is upgraded, the city can save about $12 a year in energy costs.[3] New T-5 bulbs are even smaller and more efficient.[4]

Room Occupancy Sensors

Occupancy sensors are automatic controls that detect when people enter and exit a room and adjust lighting, heating and cooling within the room as needed. Properly installed occupancy sensors can reduce energy costs associated with lighting and HVAC by up to 80%.[5] Modern sensors can self-adjust by "learning" about occupancy patterns throughout the day and warn room occupants of a pending shutdown. Override options allow room occupants to postpone sensor-triggered changes until they leave. Two types of occupancy sensors currently in the market are infrared sensors and ultrasonic sensors.

Utility Savings Initiative Fact Sheet-Occupancy Sensors allows cities to estimate the potential cost savings from adopting occupancy sensors.[6]

Energy Efficient Windows

According to the Department of Energy, 25% of the energy used to heat a building goes right out the windows.[7] The most efficient windows produced today insulate four times better than windows produced two decades ago. Multiple layers of thin plastic films suspended between the lights of glass can improve the insulation capacity of a window dramatically. Another factor is the thickness of air space locked in between the panes of glass in the windows. More air space will insulate much better than a thin air space. The insulation can be improved even more by substituting a low-conductivity gas such as argon for the air in the sealed air space.[8] Tinted glass coatings and low-emissivity (low-e) coatings reduce the amount of solar heat that enters the building while maintaining necessary light levels. Thin-walled steel, silicone foam and butyl rubber edge seals also contribute to maintaining an airtight seal and increase the insulation of windows.

---

[1] Joe Romm, Greening the Building and the Bottom Line, Increasing Productivity Through Energy Efficient Design, www.rmi.org/store/p12details963.php, 20 December 2006.
[2] ENERGY STAR® web site, www.energystar.gov/index.cfm?c=cfls.pr_cfls, 22 September 2006.
[3] T-8 Fluorescent Lamps and Electronic Ballasts, Madison Gas and Electric website, www.mge.com/business/saving/detail/t8.htm, 19 September 2006.
[4] Service Lighting, www.servicelighting.com/library/light_bulbs_fluorescent_t5_lighting.cfm, 20 December 2006.
[5] "Low-Cost Occupancy Sensor Saves Money," Atmel Applications Journal, www.atmel.com/dyn/resources/Prod_documents/mega88_3_04.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Bulidings/Atmel_mega88_3_04.pdf, 19 September 2006.
[6] Occupancy Sensors, Utilities Savings Initiative, www.p2pays.org/ref/32/31316.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/OccupancySensors_factsheet.pdf, 19 September 2006.
[7] Divya Abhat, "GREEN LIVING: HOUSE & HOME. Green Glass, Stylish Window Treatments Help Clear the Air," www.emagazine.com/view/?2858, 20 December 2006.
[8] Alpen Inc.website, www.alpeninc.com/features/hm_low_e/index.html, 20 December 2006.

Even more important than the type of glass used, is to ensure that the cracks around the windows are properly caulked. Most buildings have enough little cracks to amount to leaving a window open all year.

Retrofit City Building

CASE STUDY: Portland, OR

In 1991, the city of Portland created a program called the City Energy Challenge (CEC) to reduce overall energy use in its municipal facilities and operations.

During the ten years after its creation, the CEC saved the city of Portland $9.6 million in energy costs.[9]

That resulted in avoiding the emission of 115,000 tons of carbon dioxide during the same decade.[10] The promotion of energy efficiency in city buildings and facilities comprises a significant part of this program. The following three examples of municipal building retrofits in Portland demonstrate that upgrades of existing city buildings can provide positive returns on investment in under a decade.

The Portland Building is one of the highlights of the CEC Project. It is a 15-story municipal office building constructed in 1982 with a total floor area of 360,000 square feet. The retrofit process began in 1992 as a three-phase project to install several different energy efficient improvements throughout the building. During Phase I the building's lobby received a massive upgrade of its lighting system. Old lighting fixtures were replaced with CFLs. The interior walls received a new coat of lighter-colored paint. With these improvements, the lighting levels in the lobby increased dramatically while the total wattage used fell from 21.5 to 1.5 watts per square foot. Phase II of the Portland Building retrofit targeted the lighting fixtures throughout the rest of the building and employed similar technology upgrades. Phase III of the retrofit included the installation of a lighting control system that turns office lights off at a specified time. To avoid inconvenience, the system shutdown can be overridden by a room's occupants.

The total estimated investment of $200,000 in retrofits for the Portland Building save the city taxpayers approximately $35,000 a year in reduced energy costs.[11]

Fire Station #1
In 1994, several fire stations in Portland received major retrofits as part of the CEC project. A major upgrade of Fire Station #1 cost $80,000 to implement and saves $8,000 a year. The station's old lighting system of 300 T-12 magnetic fluorescent lights was replaced with T-8 electronic systems. Occupancy sensors were installed in many of the station's rooms. The retrofit also included a new, more efficient HVAC system.

Portland City Hall
In 1998, the CEC project turned an old, dark stuffy city hall building into a model of unique energy efficiency retrofitting. Efficient CFL light fixtures that maintained the building's historic character replaced the outdated lighting system. Walls received a new layer of insulation. New double-glazed glass windows replaced old ones that had been covered up during previous renovations. The renovation of interior atriums and their skylights that had also been hidden by previous "upgrades" provided a natural source of light throughout the building's four floors. With a total investment of $105,000, the Portland City Hall Renovation Project saves the city an estimated $15,000 a year.

[9] CEC Ten Year Report, Office of Sustainable Development, City of Portland, 2001, www.portlandonline.com/shared/cfm/image.cfm?id=111736, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/CEC_TenYearReport.pdf, 29 September 2006.
[10] Ibid.
[11] E-mail from Michael Armstrong, City of Portland, June 30, 2006.

City Facility	Investment	Annual Savings	Simple Payback	Tons of CO2 Avoided per year	$/ton CO_2 avoided
Portland Building	$200,000.00	$35,000.00	5.7 years	291.67	- $74.29
Fire Station #1	$80,000.00	$8,000.00	10 years	66.67	- $40.00
Portland City Hall	$105,000.00	$15,000	7 years	125.00	- $25.26

Table: Returns on Investment and per-ton CO_2 Reduction Costs
City of Portland Municipal Buildings[12]

Complementing the major renovations of these and other municipal buildings is the city of Portland's policy of purchasing only ENERGY STAR® or equivalent products, when available, for any equipment that uses electricity, natural gas or fuel oil. It is estimated that each non-ENERGY STAR® personal computer that is replaced with an ENERGY STAR® equivalent accounts for nearly one ton of CO2 avoided and $15-$25 of annual electricity cost savings.[13]

Funding for CEC

The Energy Challenge receives its funding through a 1% surcharge on each municipal bureau's energy bill with an annual cap of $15,000 from any one agency. The $75,000 raised covers the cost of an energy manager for the city. The City Energy Challenge saves the city an estimated $2.3 million in expenses each year.

In addition to the in-house surcharge, the State of Oregon offers tax credits for energy and building efficiency projects.

Although the city governments of the State of Oregon do not have to pay taxes and therefore do not benefit directly from a tax credit program, these tax credits may be "passed through," or transferred from the city government to other entities. This enables city governments to trade tax credits with local businesses in exchange for goods or services. The businesses can then use the tax credits, keeping the tax benefits within the community and cultivating competition among local businesses for the provision of energy efficient products.

Model Plans

City of Portland 1990 Energy Policy

City of Portland 2000 Energy Policy Progress Report[14]— *1990 Energy Policy: Impacts and Achievements*

CONTACT

Alisa Kane
Green Building Program
(503) 823-7082

[12] Michael Armstrong, city of Portland. City of Portland City Energy Challenge Ten-Year Report, Office of Sustainable Development. Note: CO2 calculations based on 15-year building lifespan, $0.085/kWh and 0.00065 tons CO2/kWh (from Climate Trust U.S. Marginal Grid Intensity Factors).

[13] Charleston Local Action Plan on Climate Change, December 2003, p. 7, www.cofc.edu/ghgas/Charleston_SC_%20LAP.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/Charleston_LAP.pdf, 29 September 2006.

[14] Portland Energy Impacts & Achievements Report, 2000, http://www.caleep.com/docs/resources/policies/Portland-energypolicyupdate2000.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/Portland_Energy2000.pdf, 19 September 2006.

Retrofit City Buildings

CASE STUDY: Tucson, AZ

In June 2006, the city of Tucson created the Office of Conservation and Sustainable Development. One of the new office's initiatives is the promotion of energy efficiency design principles and technologies in municipal facilities and throughout the desert community of 500,000 people.

The state of Arizona requires all buildings to meet the Model Energy Code (MEC), a set of national standards for lighting, insulation, window glazing and other energy efficiency features. The city of Tucson established its own energy efficiency standards for buildings in 1998 that are 50% higher than the MEC. The Tucson "Sustainable Energy Standard" applies to all new construction and renovation of municipal buildings and facilities. After positive feedback on the program from contractors and builders, the city of Tucson expanded the SES. It is now a citywide voluntary standard on all construction. The process involves designers and contractors to ensure that all parties understand the benefits and potential savings of energy efficiency.

The following table highlights the retrofit of one of the city of Tucson's municipal buildings under the SES. For additional information about the city of Tucson's energy efficiency programs, visit their web site.[15]

The Thomas O. Price Service Center Building is a city administrative office building with one floor and 23,400 square feet. In 1995, the city of Tucson began a major energy efficiency upgrade of the building, including a lighting retrofit, installation of an energy management and control system, and the replacement of a constant volume air handling system to a variable air volume system. The following chart details the costs and returns on investment of the specific retrofits.

Project	Investment	Annual Savings	Simple Payback	Tons of CO_2 avoided/year	$/ton CO_2 avoided
Lighting Retrofit	$31,300.00	$5,700.00	5.5 years	61.28	- $58.96
Occupancy sensors	$3,000.00	$375.00	8 years	4.03	- $43.42
Energy management & control system/variable air volume system (and others)	$24.993.00	$22,400.00	5.7 years	240.8	- $57.53
New roof coating	$24,993.00	$4,000.00	6.25 years	43	- $54.27
TOTAL	$187,493.00	$40,000	5.77 years	349.11	- $78.77

Table: Returns on Investment and per-ton CO_2 Reduction Costs[16]

[15] Tucson homepage, www.tucsonaz.gov, 19 September 2006.
[16] SWEEP, www.swenergy.org/casestudies/arizona/tucson_topsc.htm
Note: CO_2 calculations based on 15-year building lifespan, $0.06/kWh and 0 .000645 tons CO_2/kWh (from Climate Trust U.S. Marginal Grid Intensity Factors).

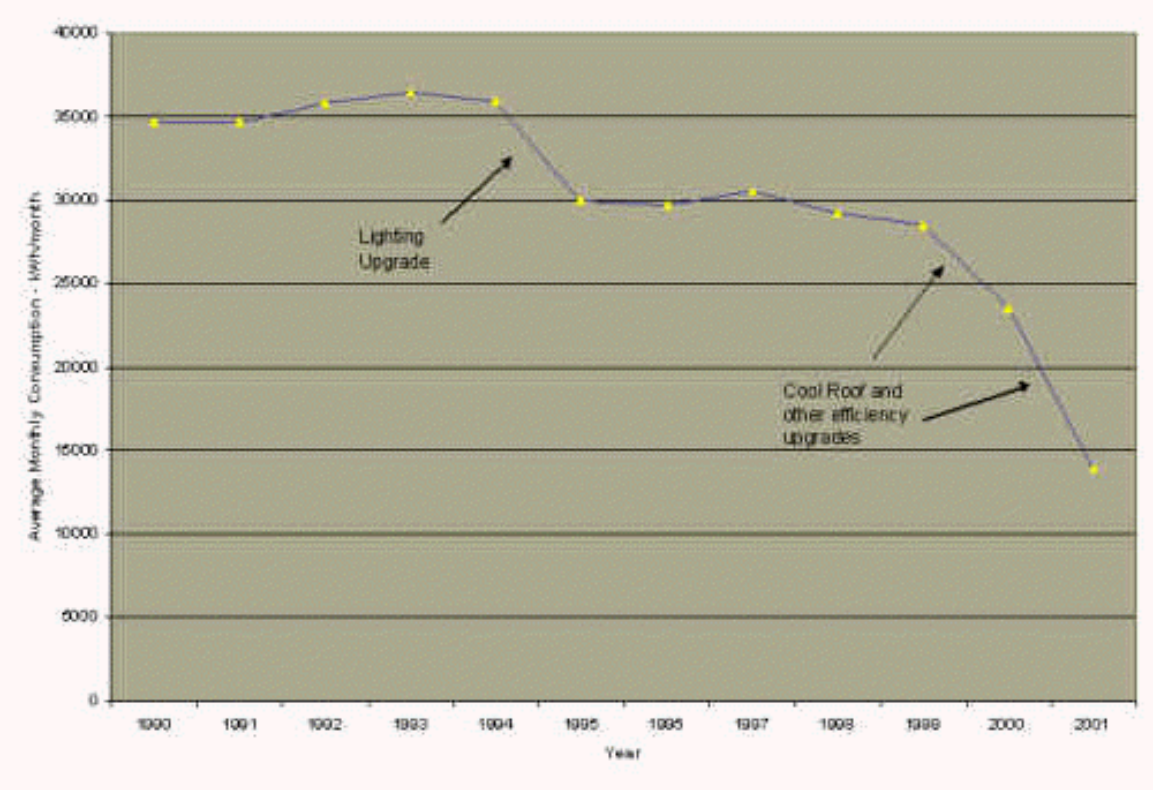

Figure : Thomas O. Price Service Center Building One, Average Monthly Electricity Use (kWh)[17]

CONTACT

Vinnie Hunt
Office of Conservation and Sustainable Development
Vinnie.Hunt@tucsonaz.gov

[17] SWEEP, www.swenergy.org/casestudies/arizona/tucson_topsc.htm, 19 September 2006.

Retrofit City Buildings

CASE STUDY: Fort Worth, TX

Between 2001 and 2003, the city of Fort Worth, Texas, reduced its electricity consumption by 16%. This was in part due to the passage of Senate Bill 5 (SB5),[18] the Texas Emissions Reduction Plan, by the Texas Legislature in 2001. The new law required all city and county governments in the state to implement all cost-effective energy efficiency measures. The law requires the governments to establish a goal of 5% reductions annually in electricity use for government facilities and operations between2002 and 2006.

The city of Fort Worth surpassed the state's efficiency benchmarks, by implementing cost-effective strategies in coordination with a private company that specializes in energy efficiency retrofit projects known as an Energy Savings Company (ESCO). In Fort Worth's case, the $3 million performance contract offered projected savings on electricity of more than 4 million kilowatt hours a year for total electricity savings of $259,000 a year.[19] The city also qualified for a sizeable rebate from the local utility.

Many states have ESPC legislation, including Florida[20] and Wisconsin[21]. There are many other resources that might be useful to a municipality exploring the use of ESCOs, including the National Association of Energy Service Companies[22] and Model Performance Contracting Legislation[23]

CONTACT

Manager
Greg Simmons
Fort Worth Facilities
(817) 392-7862
greg.simmons@fortworthgov.org

[18] Texas Legislature Online, http://www.legis.state.tx.us/, 19 September 2006.
[19] Rebuild America State and Local Government Success Story, September 2004, www.rebuild.org/attachments/SolutionCenter/Fort_Worth_FINAL102604(1).pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/Fort_Worth_rebuild.pdf, 29 September 2006.
[20] ESPS legislation—Florida www.flsenate.gov/statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=Ch0489/SEC145.HTM&Title=-%3e2003-%3eCh0489-%3eSection%20145,.also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/ESPCFloridaLegislation.pdf, 19 September 2006.
[21] ESPS legislation—Wisconsin folio.legis.state.wi.us/cgi-bin/om_isapi.dll?clientID=54264357&infobase=stats.nfo&j1=energy%20savings%20performance%20contracts&jump=energy%20savings%20performance%20contracts&record={CBA4}, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/ESPCWisconsinLegislation.pdf, 19 September 2006.
[22] National Association of Energy Service Companies, www.naesco.org, 19 September 2006.
[23] Model Performance Contracting Legislation, www.naseo.org/energy_sectors/buildings/performance_contracting.htm, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/ESPCSampleLegislation.pdf, 19 September 2006.

Retrofit City Buildings

CASE STUDY: Visalia, CA

In 2001, the city of Visalia, California[24] began work on three major projects to increase energy efficiency in their city operations.

1. Upgrading their HVAC systems
2. Replacement of the majority of building lighting
3. Installing traffic signals with LED lighting

The city hired Invensys Building Systems, a performance contracting company who guarantees energy reduction and electricity cost savings. The company will pay the difference between the expected results and actual results if expectations are not met.

The city replaced 55 HVAC Systems with Bryant (Carrier) units in 12 of the city's buildings, costing $241,098. The city received a $35,000 rebate from its utility, Southern California Electric.

Based on project estimates, the net present value of the HVAC retrofit for 10 years of energy savings is $67,015.[25]

CONTACT

Engineering & Transportation Services Manager
Britt Fussel
Visalia, CA
(559) 713-4331
bfussel@ci.visalia.ca.us

Energy Service Companies and Energy Savings Performance Contracts

Energy Service Companies (ESCOs) are private businesses that specialize in energy efficiency retrofitting projects.

City governments can contract with ESCOs to develop and implement cost-saving retrofit projects. The ESCO conducts an energy audit of the city facilities, presents an analysis of specific energy savings that can be implemented, and provides an estimated timetable for payback of costs. The ESCO finances the entire project with no upfront cost to the city. The ESCO recovers its costs and makes a profit from a percentage of the energy savings over a period of time agreed upon with the city. These contracts, known as Energy Savings Performance Contracts (ESPCs), act as a guarantee of energy savings for cities that prefer to mitigate the risk of heavy upfront costs for energy efficiency retrofit projects. Due to the tremendous amount of cost-savings potential in most buildings, payback periods for ESCOs are usually between two and ten years. Upon completion of the ESPS, the city owns a more efficient building that costs much less to operate and has a higher value.

A report issued in 2002 by the National Association of Energy Service Companies and Lawrence Berkeley National Laboratory notes that total services provided by ESCOs annually exceeds $1.9 billion.[26] The report estimates that lighting retrofits by ESCOs achieve a median 47% savings over the old lighting systems and combination lighting and non-lighting retrofits achieve a median savings of 23%. ESCOs are also a source of new jobs for the community.

Energy Savings Performance Contracts (ESPC) authorizations exist at both state and federal levels. Unfortunately, the federal Energy Savings Performance Contracting program was set to expire on October 31, 2006. Because federal authorization for ESPCs is not guaranteed beyond 2006, it is vital that states ensure the viability of ESCOs for years to come. Coalitions of environmental, labor, community and business leaders are lobbying state governments to provide this authorization.

[24] City of Visalia website, www.ci.visalia.ca.us/, 5 December 2006.
[25] Flex Your Power Example, www.fypower.org/pdf/CS_LG_Visalia.pdf, 5 December 2006.
[26] "New Report Documents $2 Billion Annual Investment in Energy Efficiency by ESCOs". National Association of Energy Service Companies, 2002.

Retrofit City Buildings

CASE STUDY: New Haven, CT

The city of New Haven, Connecticut, has saved approximately $24.7 million since a major energy overhaul. Starting in 1994, Mayor John DeStefano, Jr. and his administration identified the rising costs and usage of energy in municipal facilities as a major risk to the city's financial well-being. They took steps to mitigate the risk with energy efficiency upgrades. According to the City's Energy Conservation Program Summary in August of 2005, New Haven paid $14 million in energy-related costs for its city buildings and operations in 1994. In addition to more than 300 existing facilities and a citywide street lighting system, the city of New Haven had plans to upgrade its schools and build several new schools for the community.

The city formed an Energy Committee to analyze the energy situation and devise an action plan. The Committee wisely identified energy efficiency as the most cost-effective way to address the growing energy demand and costs. Even with the additional energy demand of 23 new and renovated schools, the Energy Conservation Program has cut the city's energy cost by $5 million per year. The city has established a goal of achieving an additional $6.1 million per year of savings by the year 2010.

The Energy Conservation Program includes an ESPC between a private contractor and the Board of Education. Over the nine years of the lease, the schools will achieve a guaranteed $8.8 million in cost savings with the installation of $6.1 million in improvements. Seven years into the Performance Contract, the Board of Education has already saved $8.35 million.[27]

The Energy Committee's strategy includes monitoring energy use and managing demand. With a series of grants from Rebuild America and other state and federal grants, as well as a performance contract with United Illuminating for the installation of infrastructure, the city installed an Energy Management System to monitor energy use and control electricity in all of its facilities from a central location. The system limits energy consumption during peak hours when electricity is much more expensive. The energy management does not adversely affect the facilities' ability to function normally.

To fund the significant investment necessary to implement the Energy Conservation Program, the city of New Haven has applied for and received $2.5 million in state and federal grants. It has also qualified for $955,501 in utility rebates and incentives as a result of its reduction in total energy use.

Among the many technologies the city has used to achieve such high levels of energy savings are:

Occupancy sensors

Upgrade of lighting with high-efficiency fluorescent lights

Replacement of old traffic lights with LED traffic lights

High pressure sodium street lights

Installation of high-efficiency motors and pumps

Energy monitoring systems

[27] City of New Haven Energy Conservation Program Summary, 30 August 2005, p. 7. Online: www.cityofnewhaven.com/Finance/pdfs/EnergyConserReport8-30-2005.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/NewHaven_EnergyConserReport.pdf, 21 September 2006.

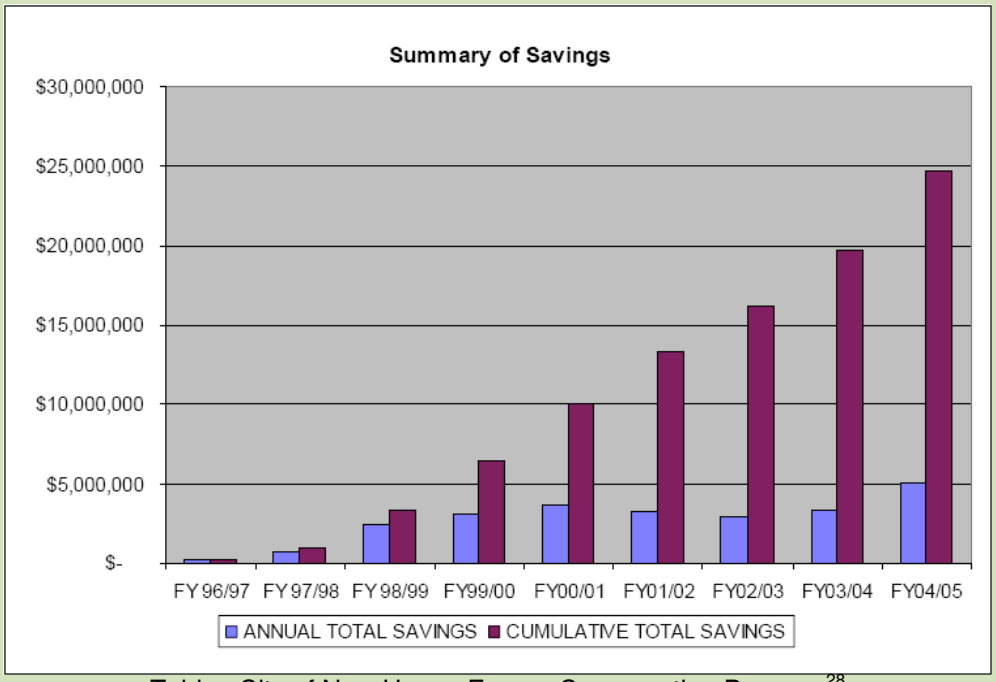

Table: City of New Haven Energy Conservation Program[28]

CONTACT

Mike Piscitelli
Comprehensive Planning
(203) 946-7814
mpiscite@newhavenct.net

Energy Efficiency Standards in New Construction and Renovations

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System is the most widespread set of national standards for buildings. It was developed by the U.S. Green Building Council (USGBC) to provide consistent guidelines in the design and construction of many types of high-performance buildings, and a quality assurance program. The LEED Rating System evaluates the building as a whole system. The building can achieve a level of Certified, Silver, Gold or Platinum, based on meeting a number of different criteria with points given for each measure.

In a report written for the California Sustainable Building Task Force in 2003, several architects and construction contractors compared the actual costs of 33 green buildings with the estimated costs of the same buildings using standard designs. The results of the survey indicate that compliance with LEED Certification standards increases upfront costs by under 2% (or $3 to $5 per square foot). This 2%

[28] Ibid.

upfront investment is estimated to produce a life-cycle savings of 20% of total construction costs.[29] Another study by Davis Langdon Seah International suggests that cost premiums for efficiency improvements can range between 1 and 4% for LEED Silver and up to 10% for LEED Platinum certification.[30] Over the course of the LEED certified buildings' lives, the savings in total costs can be as much as 10 times more than the extra cost of sustainable design.[31] An investment of $100,000 to integrate sustainable design features into a new building can therefore produce a return of $1 million in saved costs over the building's life.

LEED Standards for Retrofits include Major Renovations[32], Sustainable Operations and Maintenance of Existing Buildings[33] and Tenant Improvements of New or Existing Office Space.[34]

Benefits of Green Buildings

There are several advantages to incorporating LEED Certified designs into city buildings. By using fewer resources, the city will significantly reduce operating costs. Several studies suggest that employees are more productive and generally more satisfied working in a building that uses more natural light.[35] Another study by the Lawrence Berkeley National Laboratory indicates that reducing indoor air pollutants through green building design could save U.S. businesses $58 billion in avoided sick time and another $200 billion in increased worker productivity.[36] Incorporating green building standards for new city

buildings contributes to the protection of ecosystems and biodiversity, improves the quality of the city's air and water, sends fewer tons of waste to the city's landfills and conserves the area's natural resources. Green buildings can also be a significant public relations tool, attracting the best and brightest workers to the city's offices. A recent Harvard Business Review article on green buildings concluded that the term "green building", "Suggest lower overhead costs, greater employee productivity, less absenteeism, and stronger employee attraction and retention….Green is not simply getting more respect; it is rapidly becoming a necessity as corporations – as well as home builders, retailers, health care institutions, governments and others – push green buildings fully into the mainstream over the next five to ten years. In fact owners of standard buildings face massive obsolescence. They must act now to protect their investments. 'Building owners are starting to do reviews of their portfolios to see how green their buildings are and what they need to do to meet growing market demand.'"[37]

Life Cycle Cost Analysis

The costs to operate and maintain a building usually exceed the initial cost of its construction many times over. Life cycle cost analysis is an innovative tool for project analysis that takes these long-term costs into account when comparing different design options for a new building. It factors into the equation the following sets of costs:

Initial design and construction costs

---

[29] Greg Kats, "The Costs and Financial Benefits of Green Buildings: A Report to California's Sustainable Building Task Force", October 2003, p. viii, www.usgbc.org/Docs/News/News477.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/USGBC_News477.pdf, 19 September 2006.

[30] Lisa Faye Matthiesson and Peter Morris, "Costing Green: A Comprehensive Cost Database and Budgeting Methodology", July 2004, p. 16. Available online davislangdon-usa.com/Attachment%20Files/Research/costinggreen.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/CostingGreen.pdf, 19 September 2006.

[31] Kats, "The Costs and Financial Benefits of Green Buildings: A Report to California's Sustainable Building Task Force."

[32] U.S. Green Building Council, www.usgbc.org/DisplayPage.aspx?CMSPageID=220, 23 September 2006.

[33] U.S. Green Building Council, www.usgbc.org/DisplayPage.aspx?CMSPageID=221, 23 September 2006.

[34] U.S. Green Building Council, www.usgbc.org/DisplayPage.aspx?CMSPageID=145, 23 September 2006.

[35] Judith Heerwagen, "Do Green Buildings Enhance the Well Being of Workers?" Environmental Design and Construction Magazine. July/August 2000. Available online at www.edcmag.com/CDA/ArticleInformation/coverstory/BNPCoverStoryItem/0,4118,19794,00.html, 21 September 2006.

[36] William J. Fisk, "Health and Productivity Gains From Better Indoor Environments and Their Relationship With Energy Efficiency", Annual Review of Energy Environment. October, 2000, https://www.usgbc.org/Docs/Resources/Fisk(LBNL)HealthandProductivityEE2000.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/Fisk_HealthandProductivity_2000.pdf, 19 September 2006.

[37] Charles Lockwood, "Building the Green Way," *Harvard Business Review*, June 2006.

Operating costs (energy, water, wastewater, trash collection, recycling, and other utilities) Maintenance and repair

Environmental costs/benefits (impact on air quality, water quality, natural environment)

Social costs/benefits (productivity of workers, indoor air quality, worker sickness)

Value (positive or negative) of the building after specified lifespan timeframe

The federal government evaluates energy and water conservation projects and renewable energy projects in all federal buildings using life cycle costing methodology.[38]

Energy Efficiency Standards

CASE STUDY: Oakland, CA

In 1998, the Oakland City Council adopted a Sustainable Development Initiative as an overriding set of principles guiding the city's economic development. The Initiative includes five action points that the Council identified as the best opportunities for implementing the ambitious plan. One of the action points is the integration of green building design in all new city-funded construction projects and major renovations. The city developed sustainable design guidelines that cover site selection and preparation, transportation to/around the location, water and energy use, indoor environmental quality, selection of building materials, and waste reduction. All projects that utilize the city of Oakland funds must meet these sustainable design standards.

City LEED Mandate

Chapter 15.35 of the city of Oakland's Municipal Code[39] states:

To promote economic and environmental health in Oakland, it is key that the city itself, through the design, construction, operations and deconstruction of its own facilities, provide leadership to both the private and public sectors in the arena of energy efficiency and "green" building practices. The most immediate and meaningful way to do this is to require the integration of green building strategies in as many public city buildings as feasible.

Therefore, the purpose of these provisions is to prescribe green building requirements to covered city building projects and traditional public works projects.

The city of Oakland requires that all new buildings that cost more than $3 million and all major renovations to existing buildings that cost more than $3 million achieve LEED Silver certification or better. The law also stipulates that a LEED-accredited professional must be on the principal design team. The Oakland Sustainable Design Guide[40] is a tool that informs designers, builders, operations staff and occupants about the process of integrating green design into new and renovated city facilities. The Design Guide builds off of other green building rating systems, including LEED, Green Building Challenge '98, and BREEAM, but is uniquely tailored to fit the needs and priorities of the city of Oakland.

The Design Guide provides green building strategies that are organized according to seven environmental design topics, listed:

1. Site Strategies
2. Water Strategies
3. Energy Strategies
4. Interior Environmental Quality Strategies
5. Material Strategies
6. Waste Strategies
7. Transportation Strategies

Each of the strategies has performance indicators that must reach certain standards to obtain a specified number of points.

[38] Life Cycle Costing Manual is a guide to understand the LCC methodology established by the Federal Energy Management Program, www.bfrl.nist.gov/oae/publications/handbooks/135.pdf, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/LCCA Guide_FEMP.pdf, 27 September 2006.

[39] Full provisions of Chapter 15.35 available at www.bpcnet.com/cgi-bin/hilite.pl/codes/oakland/_DATA/TITLE15/Chapter_15_35_GREEN_BUILDING_R.html, also archived, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/Oakland_Chpt15.35.pdf, 30 October 2006.

[40] Oakland Sustainable Design Guide, www.oaklandpw.com/page46.aspx, 19 September 2006.

There are a total of one hundred points that are distributed among the strategies according to the perceived environmental and human impacts and can be weighted to reflect the city's priorities. The scoring system can also be changed to account for specific opportunities and constraints of the project.

The Oakland Sustainable Design Guide is flexible enough to allow it to grow and change with the development of new technologies and new city priorities. It is a process-oriented guide that is easy to follow and addresses the entire life cycle of the buildings. The Guide makes it easy for everyone involved in the design, construction and use of new and renovated city buildings to incorporate the principles of sustainable design and meet the requirements that the city has established.

To promote the principles of the Sustainable Design Guide among local businesses and residents, Oakland created a Green Buildings Resource Center in February 2000. The Center offers a variety of resources on site design, building products, energy/water efficiency, and solid waste management.

The city of Oakland also offers monthly lunch training sessions for city staff in green building & purchasing strategies.

CONTACT

Ferial Mosley
Public Works Agency
Environmental Services Division
(510) 238-7433
fmosley@oaklandnet.com

Energy Efficiency Standards

CASE STUDY: Salt Lake City, UT

Salt Lake City Mayor Rocky Anderson issued an Executive Order in 2005 mandating that all new municipal buildings and major renovations meet at least LEED Silver certification.[41] Salt Lake City has been a strong leader with the implementation of its Climate Action Plan.[42] By 2005 Salt Lake City has reduced the carbon emissions in its municipal operations to 21% below its 2001 baseline level. The recently-inaugurated Intermodal Transportation Hub building is LEED "certified."

The Executive Order signed by Mayor Anderson mandates:

> It is the requirement of this Executive Order that, in order to obtain the benefit of reduced operating and maintenance costs and other building efficiencies, as well. as cost-saving healthy environmental practices, the City will endeavor to apply the LEED guidelines to City construction to the extent practicable, and will design and construct facilities that will qualify for a LEED rating of at least a "Silver" level. Because LEED certification can provide significant savings beyond any initial incremental construction cost increase, the City finds that endeavoring to achieve LEED certification is in the best interest of the City

Since Executive Orders are only enforceable while the mayor that signed it is still in office, the Salt Lake City Council plans to pass a permanent version of this legislation.

The Salt Lake City High Performance Building Task Force is responsible for the implementation of LEED standards in the design and construction of new city buildings and in major renovations. There is also a significant effort to promote the construction of high performance buildings in the private sector.

> By making this commitment to high performance buildings, we will set an example for other environmentally-minded businesses, and we will help stimulate the market for sustainable building technologies…We will also explore all of our options in terms of creating incentives for businesses to implement these principles. We allocate millions of dollars each year to

[41] Executive Order: www.slcgreen.com/pdfs/execorderLEED.pdf, also archived at, http://www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/LEED_ExecutiveOrder_SLC.pdf, 21 September 2006.
[42] Salt Lake City Climate Action Plan, www.slcgreen.com/pages/actionplan.htm, 19 September 2006.

non-governmental projects through our Redevelopment Agency and Community Development Block Grants—all of which are opportunities to encourage high performance building.

-- Rocky Anderson, Mayor of Salt Lake City[43]

Results of Salt Lake City High Performance Building Standard

Intermodal Hub: When it reaches full capacity in 2008, the hub will serve as a transportation nerve center, complete with an Amtrak station, Greyhound bus depot, Utah Transit Authority bus transfer station, TRAX light rail station, commuter rail station, taxi cab stands and added amenities for bicyclists. The additional charge for building the Intermodal Hub to the LEED "certified" standard was approximately 2% of the total budget. With the LEED design saving a projected 20-25% per year in energy costs, it is estimated to payback the additional construction costs in less than 10 years.

Salt Lake City Main Library[44]: The new main library in Salt Lake City opened in 2003 and cost $65 million to construct, and although it has not received official LEED certification it incorporates many LEED elements in its design, including a five-story glass wall facing the expansive Wasatch range and a large park area outside and around the building.

The Sorenson Unity Center: Planned for Salt Lake City's Burgeoning west side, the Sorenson Unity Center is planned and budgeted for LEED certification. This will be the second LEED certified building constructed by Salt Lake City.

CONTACT

Environmental Advisor to the Mayor
Jordan Gates
(801) 535-7939
Jordan.Gates@slcgov.com

Energy Efficiency Standards

CASE STUDY: Scottsdale, AZ

On March 22, 2005, the city of Scottsdale became the first U.S. city to adopt a LEED Gold standard for all new and renovated city buildings. The new Scottsdale Senior Center, completed in 2006, is the city's first LEED Gold building.

In 1998, Scottsdale established Arizona's first Green Building Program. The residential home program is a voluntary, consumer-driven effort to encourage environmentally responsible building in the fragile ecosystem of the Sonoran Desert. The Green Building Program offers incentives to designers and construction companies that participate. Since 1998, the city has issued 932 green building permits. In 2005, 33% of all single-family residential homes achieved Scottsdale's Green Building Program standards. The program's consumer base is rapidly expanding, with an increase of 189% in green housing starts between 2004 and 2005.[45] A recent survey (conducted by the National Association of Home Builders NAHB) Research Center found that 46% of consumers expecting to buy a newly built home or spend more than $10,000 on renovations wanted to incorporate green features into their homes and did not consider the cost of green building features an obstacle.

The city of Scottsdale's Resolution No. 6644[46] requires all new city buildings of any size to be designed, contracted and

[43] Salt Lake City Press Release from 10 October 2006, www.slcgov.com/mayor/pressreleases/hp%20buildings.htm, 19 September 2006.
[44] Link to Mayor Anderson's comments on Library Inauguration, archived at www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/MayorAnderson_SLCMainLibrary_2003.pdf, 21 September 2006.
[45] City of Scottsdale Green Building Program website, "One Out of Three Scottsdale Homes are Going Green", www.scottsdaleaz.gov/news/2006./January/01-12-06.asp, 19 September 2006.
[46] Resolution No. 6644: www.ci.scottsdale.az.us/greenbuilding/LEED/LEED_ResNo6644.pdf, also archived at www.climatemanual.orgCities/Chapter5/BestBets/Buildings/Scottsdale_LEED_ResNo664419.pdf, 19 September 2006.

built to achieve LEED Gold certification. In addition, all future renovations and non-occupied city buildings must be designed, contracted and built to include as many principles of both the LEED program and the city's Green Building Program as possible. The city of Seattle is the only other US city to implement LEED Gold standards for municipal construction.

For all city of Scottsdale construction projects that have an expected simple payback of more than five years, city staff must analyze which level of LEED certification is most appropriate for that specific project and make recommendations to the City Council. This clause allows the Scottsdale City Council to maintain control over the costs of municipal construction projects. Scottsdale city staff work closely with local designers and contractors in the development of city construction projects, a relationship that stems from the strength of the Scottsdale Green Building Program.

The Scottsdale Green Building Program provides resources and incentives to both consumers and construction companies for the promotion of green buildings throughout the city. Resources available to local designers and construction contractors include a lecture series, workshops, special events and green design manuals. The educational programs provide information on energy/resource efficiency and feature experts in all areas of environmental design and construction. Green homeowners receive a "homeowner's manual" that explains the different features of their new home.

The Green Building Program[47] rates building projects in the following six environmental impact areas:

1. Site use
2. Energy
3. Indoor air quality
4. Building materials
5. Solid waste
6. Water

A green building point rating system is used to evaluate the projects. There are over 150 green building options, providing greater design flexibility while maintaining a whole building systems approach. The Green Building Program is voluntary and open to all builders in the Scottsdale area.

Builders that participate in the program are required to attend the educational programs the city offers. They must also take part in the annual events like the Green Building Expo. As a reward for their participation, builders qualify for expedited permitting and other assistance from the city, positive media exposure via construction site signs and recognition on the city's website, and a listing in the Green Building directory.

Results[48]

The new Scottsdale Senior Home[49] is 37,600 square feet and cost nearly $12 million to construct. It is the city of Scottsdale's first LEED Gold municipal building. The city estimates that the building's green features added about 2% to the total price tag and will use roughly half the power of a conventional building. The Senior Home design incorporates an array of solar panels that produce 30% of the building's electricity.

The building's location was planned in order to maximize natural light and shading. Other energy saving features include an extremely efficient heating and cooling system and a superinsulated roof. The Scottsdale Senior Home has an expected simple payback of less than five years.

The ASU Scottsdale Center for New Technology and Innovation is currently under construction and will be the largest commercial project in Scottsdale with LEED certification. The city hopes the center's green features will attract tenants and businesses that provide technology-related services.

Other city projects in the pipeline include:

Arabia Library (LEED Silver)

Police Forensic Lab

[47] For more information on Scottsdale's Green Building program visit -www.ScottsdaleAZ.gov/greenbuilding, 19 September 2006.
[48] Scottsdale Green Building Program Progress Report 2005, www.scottsdaleaz.gov/greenbuilding/Reports/0106ProgressRpt.pdf, also archived at http://www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/ScottsdaleGrnBuildingReport_2005.pdf, 21 September 2006.
[49] Senior Center Green Features, www.ci.scottsdale.az.us/smittys/pdf/SrCtrGreen.pdf, also archived at, www.natcapsolutions.org//ClimateManual/Cities/Chapter5/BestBets/Buildings/SrCtrGreen_2006.pdf, 21 September 2006.

Police District Station 1

Fire Station No. 2

Westworld Exhibit Hall

Scottsdale Center for the Performing Arts Interior Remodel (LEED Silver)

CONTACT

Director
Anthony Floyd
Green Building Program
(480) 312-7990
afloyd@scottsdaleaz.gov

Energy Efficiency Standards

CASE STUDY: Austin, TX

The city of Austin has long been recognized as the leader in municipal Green Building programs. Austin's Green Building Program was created in 1991 and is administered by the city's municipal energy utility, Austin Energy[50]. It won an award for Local Government Initiatives at the United Nations Earth Summit in Rio de Janeiro.

In addition to several programs for private homes, commercial buildings and multi-family complexes, the city of Austin requires all new city-funded projects to attain LEED Silver certification.

Their user-friendly website[51] contains detailed information on the city's program and has links to many case studies and resources.

CONTACT

Green Building Program
(512) 482-5300

Energy Audits in Major Municipal Buildings

Energy audits are the first step in retrofitting municipal buildings. By conducting an audit, cities become aware of the areas needing improvement. Most cities first evaluate buildings based on their financial accounting system. Financial systems can show inefficiencies through increased energy consumption and cost in their buildings. The next step is to conduct an energy audit and then update existing buildings to make them more energy efficient. Other cities need conduct an audit to determine how to allocate budget for future municipal building improvements.

The New Jersey Department of Environmental Protection explains in their Energy Audit Guide[52] the three types of audits. Each is described in order of increasing degree of detail. The type of audit used is discussed at the preliminary consultation stage.

1. Walk-through Audit. This is the least expensive. It involves an examination of the building or facility, including a visual inspection of each of the associated systems. Historic energy usage data are reviewed to analyze patterns of energy use and compare them with sector/industry averages or benchmarks for similar

[50] www.austinenergy.com/Energy%20Efficiency/Programs/Green%20Building/index.htm, 19 September 2006.
[51] Austin's main web site: www.ci.austin.tx.us/, 19 September 2006.
[52] New Jersey Department of Environmental Protection "How to Conduct an Energy Audit: A Short Guide for Local Governments and Communities" www.njcleanenergy.com/media/Energy_Audit_Guide.pdf#search=%22Municipal%20Buildings%20Energy%20Audit%22, 19 September 2006. This resource explains the audit process, types of audits and the steps required to conduct an audit for local governments, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/Energy_Audit_Guide.pdf, 19 September 2006.

structures. The walk-through audit provides an initial estimate of potential savings and generates a menu of inexpensive savings options usually involving incremental improvements in O&M. Information from this level of audit also serves as a basis for determining if a more comprehensive audit will be needed.

2. Standard Audit.
   This involves a more comprehensive and highly detailed evaluation. Facilities, equipment, operational systems and conditions are assessed thoroughly and on-site measurements and testing are conducted to arrive at a careful quantification of energy use, including losses. The energy efficiencies of the various systems are determined using accepted energy engineering computational techniques. Technical changes and improvements in each of the systems are analyzed to determine the corresponding potential energy and cost savings. In addition, the standard audit will include an economic analysis of the proposed technological improvements and ECM.

3. Computer Simulation.
   The computer simulation approach is the most expensive and often is recommended for more complicated systems, structures or facilities. This involves using computer simulation software for prediction purposes (i.e., performance of buildings and systems) and consideration of effects of external factors (e.g., changes in weather and other conditions). With the computer simulation audit, a baseline related to a facility's actual energy use is established, against which effects of system improvements are compared. This audit often is used for assessing energy performance of new buildings based on different design configurations and equipment packages.

Energy Audits

CASE STUDY: Boothbay Harbor, ME

In 2005, Boothbay Harbor Town Manager, Carlo Pilgrim, decided to have an energy audit done on the municipal building after the electric bills were consistently high. The audit revealed that in 2004 of the total $12,247 electric costs, 73% or $8,999 was spent on electricity and 27% or $3,248 was spent on fuel oil. Of these numbers the audit suggested around 50% of electricity used was from the lighting. Various suggestions were made for do-it-yourself measures. These were the suggested changes for lighting:

Repaint or clean reflective surfaces

Reset exterior lighting schedule

Relamp incandescent to compact fluorescent Service Technician:

Install occupancy sensors in bathrooms

Install photoelectric cells

Install additional switching

Relamp outside lights to high pressure sodium

These lighting changes alone were estimated to save the town 14,304 kilowatt-hours of electricity per year at a savings of $1,559.18. Boothbay Harbor requested bids on an electrical update of the municipal building based on Mayhews recommendations in the January 20 and 27 issues of the Register. As of January 28, the town had not received any bids on the project.[53]

CONTACT

Town Manager
Carlo Pilgrim
Code Enforcement
Office/Maintenance Repairs
Dabney Lewis
(207) 633-7714

[53] Boothbay Register, boothbayregister.maine.com/2005-02-03/municipal_makeover.html, 19 September 2006.

Energy Audits

CASE STUDY: Southlake, TX

The city of Southlake put in place a comprehensive energy policy in 2002. Part of this plan called for periodic energy audits.

> The city shall periodically schedule energy audits of city facilities and current overall energy consumption. The data from these audits shall be used for the purposes of energy conservation planning, budget development, and serving as a basis for designated operational reviews to identify methods to increase energy conservation. Recommendations from energy audits will be evaluated based on the criterion of cost effectiveness and upon the impact on service delivery to city residents.[54]

Having this clearly stated in the energy policy is a clear reminder to inspectors to take energy issues into consideration for all audits and building modifications.

CONTACT

Building Inspections
(817) 748-8218

Energy Audits

CASE STUDY: Berkeley, CA

Berkeley is continually auditing their residential, commercial and municipal buildings to maintain records about potential upgrades and retrofits. Audits are typically performed when a new technology is discovered that could improve specific facility operations, when billing information reveals increases in energy consumption per square foot and cost, and for general follow up to maintain records. Berkley's Energy Office conducted approximately 2,000 energy audits in 2003 in the residential, commercial, industrial and local governmental sector. The following breaks down audits done in each sector[55].

Residential

500/yr. Residential Energy Conservation Ordinance (RECO) audits

300/yr. CA Youth Energy Services audits

130/yr. Weatherization audits

Commercial

Berkeley has set a target of 1,500 commercial audits by 2003 (over 1.5 years) as part of its Smart Lights program.

One thousand of these audits will include lighting improvements.

70% of these audits will occur in Berkeley, thirty will occur in neighboring cities.

Industrial

32 industrial audits/yr. as part of Climate Wise (a national program designed to reduce greenhouse gas emissions through resource conservation and efficiency).

Municipal
5 municipal audits/year.

CONTACT

Energy Officer
Neal Desnoo
Office of Energy and Sustainable Development
(510) 981-5434

[54] Southlake Policies and Procedures, www.seco.cpa.state.tx.us/zzz_sb5-tep/sb5southlake.pdf#search=%22city%20municipal%20energy%20audits%22, 19 September 2006.
[55] Sustainability Community Inventory, Energy (2003) www.ci.berkeley.ca.us/sustainable/community/08_Energy.pdf#search=%22city%20municipal%20energy%20audits%20policies%22, also archived at, www.climatemanual.org/Cities/Chapter5/BestBets/Buildings/Berkeley_Energy.pdf, 19 September 2006.

Additional Resources

The U.S. Green Building Council
www.usgbc.org

The State of Minnesota Sustainable Building Guidelines
www.moea.state.mn.us/greenbuilding/cost.cfm

Green Building Professionals Directory
www.greenbuilder.com

Oikos Green Building Source
oikos.com/

Build It Green promotes healthy, energy and resource-efficient buildings in California
www.builditgreen.org/

Green Building Resource Guide
www.greenguide.com/

California Green Building Design and Construction
www.ciwmb.ca.gov/GreenBuilding/

BuildingGreen.com publishes *Green Building Products*, a residential green product directory, and *Environmental Building News*, a highly respected monthly newsletter.
www.buildinggreen.com/

The ENERGY STAR® Challenge
www.energystar.gov/ia/business/leaders/Summary_of_States3.pdf

Green Schools Resources
www.nesea.org/buildings/greenschoolsresources.html

Additional Links and Resources
www.greenbuildingpages.com/links/weblinks_gov.html

Minnesota Sustainable Design Guide
www.develop.csbr.umn.edu/msdg2/MSDG/overview.html

"Implement"- Seattle's Sustainable Building Tool
www2.ci.seattle.wa.us/Implement/

U.S. Department of Energy Building Energy Codes Program is an information resource on national model energy codes. They work with other government agencies, state and local jurisdictions, national code organizations, and industry to promote stronger building energy codes and help states adopt, implement, and enforce those codes
www.energycodes.gov/

Flex Your Power is a resource for energy efficiency and conservation information
www.fypower.org/

G/Rated is Portland's gateway to green building innovation, offering initial consultation and resources specific to your green building project. Under the direction of Commissioner-in-charge Dan Saltzman,G/Rated is accelerating the adoption of cost effective green building practices as the standard of development in Portland.
www.green-rated.org

Seattle's Sustainable Building Program
www.seattle.gov/light/conserve/sustainability/

Austin, TX Sustainable Building Sourcebook contains information relevant to the Austin area, such as regulatory issues, climate, installation guidelines, and sources of assistance. The Sourcebook also provides pertinent information on various aspects of sustainable building strategies and possible implementation issues that may be found in less familiar approaches to building.
www.austinenergy.com/Energy%20Efficiency/Programs/Green%20Building/Sourcebook/index.htm

For more resources, check the footnotes of this document.

NATURAL CAPITALISM SOLUTIONS

NATURAL CAPITALISM SOLUTIONS IS A 501(C)3 NON-PROFIT ORGANIZATION
WWW.NATCAPSOLUTIONS.ORG • P.O. BOX 398 • ELDORADO SPRINGS, CO 80025
INFO@NATCAPSOLUTIONS.ORG • TEL: 303-554-0723 • FAX: 303-554-6548