

Green Asset Management Toolkit *for Multifamily Housing*



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Enterprise Green Communities provides funds and expertise to enable developers to build and rehabilitate homes that are healthier, more energy efficient and better for the environment – without compromising affordability. Green Communities also assists state and local governments to ensure their housing and economic development policies are smart and sustainable. Enterprise Green Communities homes are built according to the Green Communities Criteria, the first national framework for healthy, efficient, environmentally smart affordable homes. The next generation of Enterprise Green Communities launched on Oct. 21, 2009, with a national call to action and a \$4 billion commitment to green affordable housing. Learn more at www.greencommunitiesonline.org.

Enterprise is a leading provider of the development capital and expertise it takes to create decent, affordable homes and rebuild communities. For more than 25 years, Enterprise has introduced neighborhood solutions through public-private partnerships with financial institutions, governments, community organizations and others that share our vision. Enterprise has raised and invested more than \$10 billion in equity, grants and loans to help build or preserve more than 250,000 affordable rental and for-sale homes to create vital communities. Enterprise is currently investing in communities at a rate of \$1 billion a year. Visit www.enterprisecommunity.org and www.enterprisecommunity.com to learn more about Enterprise's efforts to build communities and opportunity.

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Five Easy Ways To Begin Saving Money, Energy, and Water

Want to start now to save money and resources? Here are five quick steps that make a big impact.

- 1. Replace incandescent light bulbs with compact fluorescent light (CFL) bulbs or low-emitting diodes (LED), and add motion sensors on common space and exterior lighting,** except where safety and security are an issue. ENERGY STAR® qualified CFLs use approximately 25 percent of the energy incandescent bulbs use and last up to 10 times as long.¹ The wide variety of available sizes and shapes will fit almost any indoor or outdoor fixture.
- 2. Add demand controls to the hot water recirculation loop, insulate all exposed hot water piping, and turn down water heater/boiler thermostats** to the minimum temperature required for accommodating hot water needs.
- 3. Upgrade laundry equipment, refrigerators, and dishwashers to ENERGY STAR® appliances** and reduce energy usage and water consumption by 10 to 50 percent.
- 4. Repair leaks and install sink aerators, low-flow shower heads, and toilet tank flappers** to reduce the amount of water used.
- 5. Repair and aim sprinklers** to deliver water only to where it is needed, and **add weather-based irrigation controls** to limit overwatering when rain is expected.

Resident behavior is an important part of the efficiency equation. ENERGY STAR® and your local utility companies (energy and water) can provide tips, resources, and incentives to pass along to residents, promoting energy and water conservation through behavioral change and savvy consumerism. Ask your local energy and water utilities for more information about their consumer education resources, and visit the ENERGY STAR® website.

You can also encourage recycling through offering information on recycling centers and providing recycling bins.

¹ENERGY STAR® lighting, www.energystar.gov/index.cfm?c=lighting.pr_lighting



SECTION 1 INTRODUCTION

1.1 LOOKING TO GO GREEN?

Then you've come to the right place. If you are interested in what this toolkit has to offer, chances are you are associated with a housing site as an owner, asset manager or maintenance staff person and you're looking to make some green changes to your management practices. We want to congratulate you on your decision to make a difference and extend a welcoming and helping hand. Enterprise launched the Green Communities initiative in 2004, building on more than two decades of creating decent, quality, affordable homes and communities for low-income families. As of October 2009, Enterprise has successfully supported the preservation or creation of almost 16,000 green affordable homes. We've also trained over 4,000 housing professionals in green development. Throughout the process we have benefited greatly from lessons learned, and this toolkit is our way of sharing some of these with you. A national leader in investment capital and development solutions for affordable housing and community revitalization, Enterprise has invested more than \$10 billion since 1982 to help finance more than 250,000 affordable homes in

communities across the nation. Enterprise has introduced neighborhood solutions through public-private partnerships with financial institutions, governments, community organizations and others that share our vision.

Whether you are just getting started or already have plenty of experience, you should be able to find the level of help you need in this guide. We have included information on quick and easy projects that can be implemented with minimal effort, more robust measures that can be carried out on a one-off basis as you replace failing equipment or address individual building issues, and more challenging rehabilitation projects that involve a holistic approach to renovating a building with green goals in mind. You'll also find tips on putting together a team of professionals to take on the job of planning, implementing and monitoring the success of your green projects, choosing the correct financial tools for estimating costs and benefits, identifying funding sources, benchmarking and tracking your progress, and many other relevant topics. Whatever your goals and needs, chances are you will find the right range of information, advice and practical tools for the projects you have in mind.

Along with providing practical advice for evolving your housing asset into a green living space, we've designed this manual to support your decision-making process. That's why we've decided to start with a review of the many reasons why going green makes good sense. We hope it will help answer your questions and confirm your choices, as well as

offer information to pass along to others who will undoubtedly be inspired by your efforts.

1.2 GREEN ASSET MANAGEMENT PROCESS DIAGRAM

The Green Asset Management Flow Diagram can guide you to the appropriate sections, depending on where you are in the process.

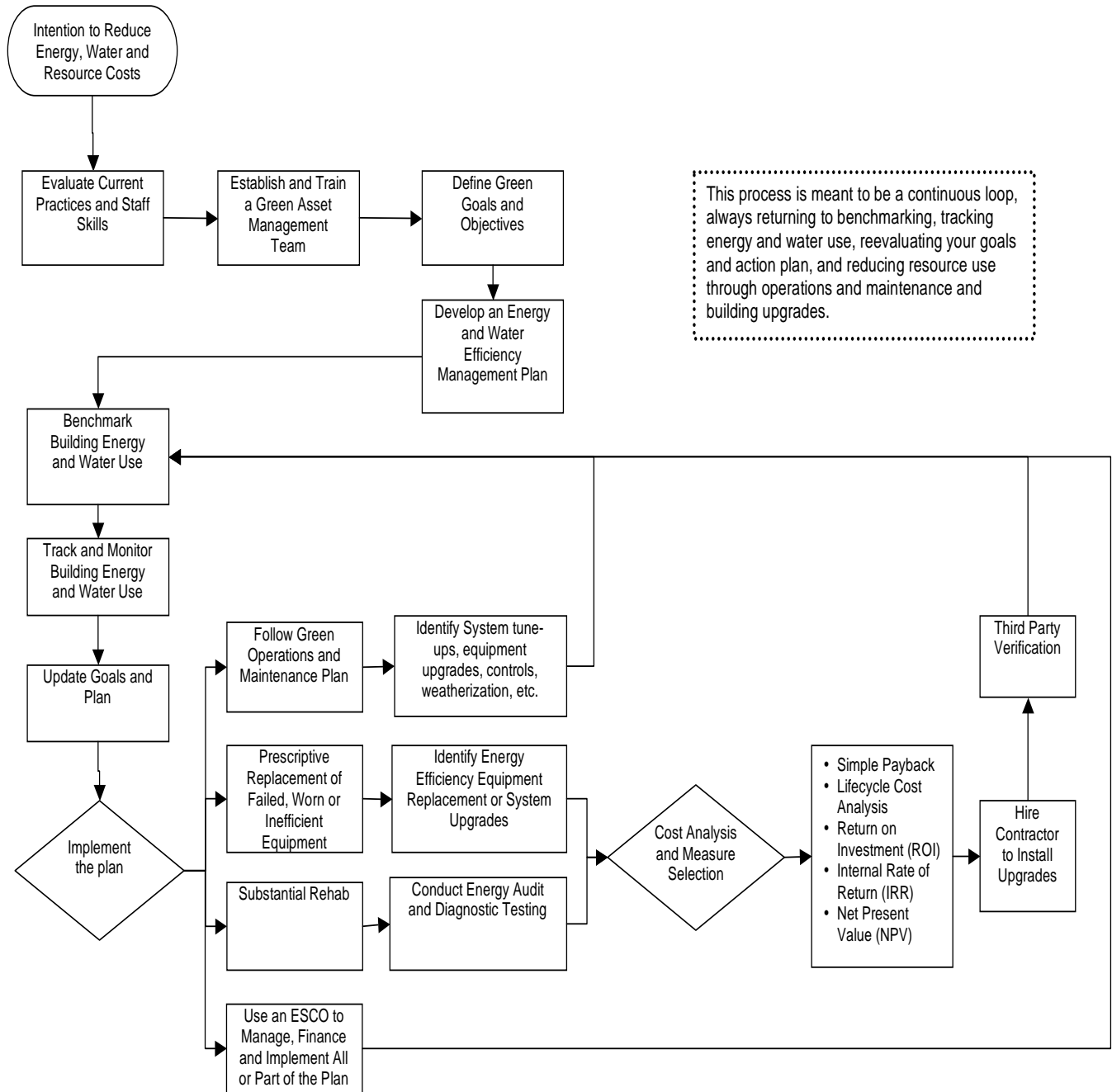


Figure 1



SECTION 2 WHY GREEN OPERATIONS MAKE SENSE

The simple truth is that green asset management is a powerful tool for improving housing performance. While popular perception often paints a picture of green building focused programs as laden with obstacles that weigh down the management process, growing evidence of the effectiveness of green asset management consistently points to the opposite: a green approach improves housing performance in a number of important ways. With green asset management, operating costs go down, tax credit opportunities go up, environmental hazards are reduced, resident utility savings improve, and potential residents are drawn to the attractiveness of a healthy, green living environment. Simply translated, this means that whatever your role; asset manager, property manager, housing director, executive director, investor or owner going green can make your job easier in the long run, and help

Growing evidence as to the effectiveness of green asset management consistently points to the fact that a green approach improves housing performance in a number of important ways.

you achieve greater success with your property on a number of different fronts.

A major focus in green asset management is the way in which maintenance is handled, and going green means instituting maintenance practices that work best over the long term. No matter how a property was originally designed and constructed, its performance can be significantly improved

when ongoing maintenance is carried out with health, sustainability and efficiency in mind.

Monitoring energy and water usage is as important

a component of asset management as the proper operation and maintenance of equipment.

This toolkit provides resources for enhancing performance in these key areas, including:

- Reducing energy and water consumption
- Lowering greenhouse gas emissions
- Improving indoor air quality
- Lengthening the lifespan of equipment and systems

While such measures are commonplace in properties that were designed and built to be green from the start, this manual specifically targets buildings with little or no history of green building priorities in their past. The tools we've included are tailored to meet the needs of those seeking to move traditional building management practices in a greener direction.

What is Green Asset Management?

Green asset management builds on standard property management approaches, taking them a step further to promote sustainability and healthy living. This means that in addition to conventional management goals, new objectives are established that make a priority of the health, economic and environmental performance of a housing property. Traditionally, asset management has aimed to sustain the durability of properties so that they perform well over an extended life cycle. Thus, housing professionals have typically focused on maximizing the financial, physical and regulatory condition of a portfolio, as well as monitoring compliance with operating agreements and the owner's goals.

Green asset management expands this focus, particularly in the area of a building's physical condition, to encompass new strategies, tools, techniques and products for promoting durability and longevity while increasing energy and water conservation and maintaining a healthy indoor environment. Some of the measures described in this manual will have originated from time-tested best practices in the industry. Others are the result

of new research which, combined with recent consumer demand for green housing, has helped bring innovation to the marketplace.

2.1 THE CASE FOR GREEN ASSET MANAGEMENT

There are many benefits to be realized from green asset management, particularly for your project's bottom line. As noted in the article "Sustainable O&M Practices," these can include:

- Reduced solid and hazardous waste generation
- Lower levels of air pollution
- Extended service life for equipment and building materials
- Reduced utility bills
- Fewer employee sick days and a reduction in worker's compensation claims
- Better indoor air quality and associated occupant thermal comfort
- Fewer occupant complaints¹

Reducing a building's energy and water consumption will help mitigate the impact of sudden increases in costs.

Altogether, these advantages add up to an attractive and progressive housing package for tenants, managers and owners alike. This reflects one of the key factors behind the success of green asset management – everyone benefits. Owners, managers and investors profit from lower costs and minimized risks; tenants and employees enjoy improved health and comfort levels;

¹ "Sustainable O&M Practices," Whole Building Design Guide, available at www.wbdg.org/resources/sustainableom.php

and the community gains from more positive environmental conditions.

More generally, a green asset management approach can help your portfolio achieve a high level of performance in a number of areas. These advantages are described in detail below.

Environmental Benefits

Green asset management makes a significant impact on both the immediate environment and the wider surrounding area. Solid and hazardous waste generation is significantly reduced, benefiting local landfills. Air and water pollution are minimized, greenhouse gas emissions are lowered, and the reduction in energy and water use means natural resources are conserved.

Resident Marketing and Retention

Greener buildings cost less to operate, use fewer harmful products and cleaners, and are healthier and more appealing to potential residents. Furthermore, lower operating costs help retain residents by providing housing that is more affordable to maintain than comparable non-green homes. A physically and financially comfortable residence will generate a lower turnover rate.

Risk Mitigation

Green asset management reduces the risk of building damage and hazards. It includes a durability plan that considers heat, air flow and excessive moisture within a building. Green management plans also focus on addressing aspects of building maintenance that can compromise longevity, such as water penetration resulting

in moisture that can lead to mold or rodents.

Addressing such factors can significantly mitigate insurance risk. Reducing a building's energy and water consumption will help mitigate the impact of sudden increases in costs.

Lower Costs

Green asset management reduces expenses. As the cost of resources such as oil, natural gas and water continue to increase over time, the use of these resources results in ever-rising operating expenses. However, buildings that are energy and water efficient can help control such spiraling expenditures, keeping operating costs lower than those of comparable buildings that do not have green asset management practices in place. And of course, lower operating costs can contribute to increases in net operating income.

As an example, meeting the Enterprise Green Communities Criteria yields striking savings in utility costs, especially when compared to the cost of implementing the Criteria's energy- and water-conservation measures. These savings make the cost of implementing the Criteria (\$4,524) financially attractive. When considering the benefits revealed in our study, the average cost per dwelling unit to incorporate the energy and water criteria was \$1,917, returning \$4,851 in predicted lifetime utility cost savings (discounted to 2009 dollars).¹ In other words, the energy and water conservation measures not only paid for themselves but also produced another **\$2,900 in projected lifetime savings per unit.**¹

¹ Incremental Cost, Measurable Savings: Enterprise Green Communities Criteria, 2009, www.greencommunitiesonline.org.

When it comes to lowering costs, many factors can impact your bottom line results. Depending on the scope of your goals, you will find differing levels of trade-off between the amount you invest up front in various green projects, and your long-term operational savings. This toolkit will walk you through a detailed and accurate planning process so you can proceed with confidence concerning the level of investment that is optimal for you. In addition, we've provided a detailed description of useful cost analysis methods in [Section 3.10 \(p. 25\): *Methods of Cost Analysis*](#).

Increased Comfort and Health for Residents and Employees

Green asset management means healthier residents and staff. When the products and materials used in property upkeep are taken into consideration as a matter of procedure, it is easy to identify and give preference to those that are less polluting and healthier than conventional choices. Air quality is a major factor in a building's overall environment health, and thus green management emphasizes a ventilation system that removes pollutants tracked in from outside, while bringing in ample fresh air.

The same measures applied to a building's envelope and space conditioning in order to maximize energy efficiency also act to improve resident comfort by maintaining consistent and appropriate indoor temperatures. This, in turn, reduces the number of calls from residents about heating and cooling complaints, and can be especially beneficial in senior and special needs housing where residents are more sensitive to temperature changes. Green

management involves the careful monitoring of energy and water usage, allowing management to act quickly when systems are under- or over-performing. Consequently, there is close supervision of indoor temperature conditions and as a result, resident comfort is optimized.



Hotel Essex, San Francisco, CA



SECTION 3 ESTABLISHING A FOUNDATION AND FRAMEWORK

3.1 CHOOSING AN APPROACH

Defining the scale of a green upgrade project is the first step in creating a plan of action specific to that project. Whether the scope of the project

The best way to provide concrete evidence that your projects and improvements are making a difference is by **measuring performance before, during, and after** implementing the modifications you have chosen.

includes major improvements or quick, low-cost fixes, there are many options for achieving cost effective energy and water savings. This section defines various approaches to green upgrades, explaining when each strategy is appropriate, and offering examples of possible upgrades in the given project category.

3.2 EASY FIXES

This list contains ideas for increasing energy and water efficiency that require little upfront investment and offer quick payback. These are steps everyone can take because they don't require large amounts of time or money – just a little planning and effort. Many measures that fall under this category are often considered regular maintenance practices and can be implemented at any time in a building's lifecycle. But don't let their humble scope fool you – over time, the returns in terms of financial savings and conservation of resources can be considerable.

Improvements in this category include:

- Switching incandescent light bulbs and fixtures with fluorescents or LEDs
- Weatherizing to seal the building envelope
- HVAC tune-ups
- Duct sealing
- Water heater or boiler tune-ups
- Adding recirculation controls
- Replacing pool pumps
- Adjusting thermostat temperature settings on space and water heating systems
- Insulating water heaters or boilers
- Adjusting refrigerator and freezer temperatures
- Installing low-flow showerheads and sink aerators
- Installing toilet tank flappers

3.3 PRESCRIPTIVE RETROFITS

The failure of older equipment that has become too worn for continued use presents an ideal opportunity for selecting a more energy efficient replacement, and it makes sense to respond with a prescriptive retrofit. A prescriptive approach is simply replacing equipment on a one-by-one basis over time, rather than refitting a whole building at once in order to achieve an immediate transformation in its performance level. Prescriptive retrofits are appropriate and effective for any portfolio without plans or funds for substantial improvements, and are designed to meet time-sensitive needs for replacing specific equipment, appliances or lighting. While whole-building approaches take into account the synergistic impact of replacing or upgrading multiple systems, only the savings related to the reduction in energy and water use associated with the replaced equipment is considered in prescriptive retrofit analyses.

Prescriptive retrofit measures include, but are not limited to, the replacement of:

- Space heating equipment
- Space cooling equipment
- Water heaters/boilers
- Recirculation pumps
- Light fixtures
- Ceiling fans
- Refrigerators
- Dishwashers
- Clothes washers and dryers
- Broken windows

In some circumstances, prescriptive measures are taken during other types of building repairs to avoid losing the opportunity for an easier, quicker and thus often cheaper, change of equipment. A few examples are:

- Pipe, duct, wall, floor or ceiling insulation installation when an otherwise inaccessible building cavity is opened
- Installation of radiant barrier and/or cool roof products during a roof replacement

3.4 PERFORMANCE-BASED SUBSTANTIAL REHABILITATION

A performance-based approach to upgrading energy and water efficiency is the method of choice if you are planning substantial building improvements or remodeling. This approach has the capacity to factor in the interrelationship of various building components and systems, as well as accommodate the uniqueness of your specific project.

Building Evaluation/Audit

To follow the performance-based approach, you will first need to arrange for an evaluation or audit of the building's performance statistics, such as a building simulation analysis. This will allow you to base your choice of energy and water upgrade packages on concrete data. To begin this process, contact an energy consultant to decide how best to conduct the audit. One possibility is to have your green asset management team use a worksheet to collect information on existing building conditions. In this scenario, the team can also use the data collection to become more familiar with the site's energy and water use. Alternatively, the energy

consultant (or a HERS rater) can come to your site to conduct the building audit. This option is likely to be more efficient and yield more accurate results.

Energy and Measures Analysis

Once this audit data is collected, an energy consultant will plug it into simulation software that will estimate the current energy use of your building. This establishes a baseline that will then be used for comparison with the upgrade options under consideration. The software simulation typically involves modeling complex interactions between building systems and components to yield an accurate picture of energy and cost savings for each upgrade scenario. Using the projected energy savings and estimated upgrade costs, your asset management team will be able to effectively analyze the options and choose the best improvement package for your project.

3.5 TOOLS

Building Audit Worksheet – Heschong Mahone Group

This worksheet provides a tool for documenting your existing building conditions. It can be used by building managers, HERS raters or energy consultants to collect the information that will be plugged into an energy simulation program for establishing baseline energy use.

[*Audit Worksheet: Appendix A \(p. 87\)*](#)

Energy Efficient Rehab Advisor

The U.S. Department of Energy has developed this tool for existing multifamily homes to provide easy access to tailored suggestions for energy upgrades. Plug in your building characteristics, and a list of recommended improvements will be presented, complete with estimated costs and payback periods. This tool cannot take the place of a full building audit and energy simulation, but is useful for creating a rudimentary guide that can serve as a starting place for potential next steps.

→ www.rehabadvisor.pathnet.org/calculator.asp

How to Hire an Energy Services Company (ESCO)

This document, written by the California Energy Commission, explains the purposes and roles of an Energy Services Company, and stipulates how and when an ESCO should be hired.

→ www.energy.ca.gov/reports/efficiency_handbooks/400-00-001D.PDF

Retro-Commissioning Toolkit – California Commission Collaborative

This website offers several workbooks, some of which are classified as energy-saving tools and others as data analysis tools. The energy-saving tools are for use in calculating energy savings related to specific retro-commissioning measures – i.e., variable flow pumping systems and variable volume fan systems. The data analysis tools contain templates for recording, organizing and analyzing information gleaned in the retro-commissioning process.

→ www.cacx.org/resources/rcxtools/spreadsheet_tools.html

Additional Tools

Energy Conservation for Housing – A Workbook:

Housing and Urban Development (HUD)

This workbook is intended to be a guide for Housing Authorities (HA) that are interested in making energy conservation improvements. It is designed to provide assistance to HA staff with varying degrees of technical proficiency and energy conservation experience.

→ www.abtassoc.com/reports/D19980034.pdf

TREAT – Targeted Residential Energy Analysis

Tools: Performance Systems Development

TREAT is innovative software designed to provide support for weatherization programs, building performance contractors and energy auditors. The New York State Energy Research and Development Authority funded development of this tool, which creates models of buildings, integrates the models with weather and energy information and provides appropriate assessments and recommendations.

→ www.psdconsulting.com/software/treat

3.6 RESOURCES

Professional Home Energy Audit

This site outlines steps for receiving a home energy audit, including preparing for the audit, selecting a professional and locating resources for home energy audits.

→ www.energysavers.gov/your_home/energy_audits/index.cfm/mytopic=11180

HUD Rehabilitation Energy Guidelines for Multifamily Dwellings

This guidebook explains how property owners who are considering rehabilitating multifamily buildings can increase energy efficiency and reduce costs in the process. It discusses key issues and factors that determine how much energy a multifamily building consumes, such as heat flow, air leakage, insulation and heating and cooling systems.

→ www.huduser.org/publications/destech/multi.html

Additional Resources

RESNET National Standard for Home Energy Audits

These criteria have been set by Residential Energy Services Network to define and standardize national procedures for home energy ratings. The list provided at the link below defines the accepted framework for carrying out a home energy audit.

→ www.resnet.us/standards/audit/National_Energy_Audit_Standard.pdf

A Retro-Commissioning Guide for Building

Owners: Portland Energy Conservation, Inc. for EPA

This extensive guidebook offers information on how you can use retro-commissioning as a cost-effective method for reducing expenses and increasing revenue through improved building operations.

→ www.peci.org/documents/EPAguide.pdf

Green Buildings and Energy Efficiency: Energy is the First Step to Green – Environmental Protection Agency, ENERGY STAR®

Most people would agree that a green building must be an energy-efficient building, but not everyone agrees on how to define and quantify efficiency. The link below can help ensure your buildings deliver measurable results.

www.energystar.gov/index.cfm?c=green_buildings.green_buildings_index

3.7 STEPS IN GREEN ASSET MANAGEMENT

Just as with any other management process, green asset management is successful when there is an established structure in place for setting goals, tracking performance and evaluating progress. This section outlines steps for building such a structure and implementing a green asset management plan.

Step 1: Assemble Team and Make a Commitment

All buildings, either new or rehabilitated, are the result of specific design choices. Each building's history is comprised of a unique set of decisions made over its lifetime. For example, while some buildings are conceived with green priorities in mind, others are never considered from a green standpoint until long after construction is finished. Nonetheless, certain foundational elements are necessary in every asset management scenario because they create an effective base for turning goals into reality. One such element is the establishment of a green asset management team. Creating this team is your first crucial step in

Identify those tasks which require the involvement of professionals outside the green asset management team, experts such as consultants, contractors, and vendors whose knowledge and skills are essential to the project's success.

supporting a successful and sustained commitment to green operations. Whether large or small, your team should be made up of committed individuals who, as much as possible, represent a cross section of the departments involved in property management, development and finance.

The Players

A critical aspect of an effective green asset management team is their level of dedication to the effort. The skills and commitment of your team members will provide the energy to translate your plans into action. While outside consultants may come and go, the internal team will remain constant.

When looking to build a team supportive of green asset management, a natural place to start in soliciting input is with the persons responsible for the original design of the building. They offer a continuity of knowledge about the building

and are likely to be motivated to see the building succeed in the long term. This is especially important for buildings with uncommon features or systems, where the original design intent may

be an essential piece of information in any future alteration or improvement. The goal of including designer input is to gain knowledge of how the building was originally designed and how the existing equipment and systems were intended to be used.

Another potential source of team members is property and asset management staff. They are the ones who will ultimately implement the management plan and thus have a significant stake in any decisions that are made. Having a say in the process of developing the plan will no doubt increase their investment in making sure it is carried out consistently and effectively.

When recruiting candidates for your team, keep in mind that professionals whose jobs involve implementing green building projects on a regular basis most likely have the right combination of skill, experience and commitment for your effort. You can find more detailed information on professions specifically related to green asset management in [Section 3.17 \(p. 32\): Building Professionals and Quality Assurance](#).

It can also be fruitful to look closer to home for possible team members. Chances are, you will find employees inside the building owner's own organization who possess not only the appropriate set of skills and experience, but also have considerable interest in taking part in a green venture. You may want to consider staff members representing the following disciplines:

- Design and engineering
- Asset management
- Property management
- Construction management
- Operations and maintenance
- Finance

Finding the right managers for the team from within your organization can be relatively

straightforward, as the strengths and weaknesses of individual managers are often commonly recognized and good management skills usually transfer well to new challenges. If you do happen to include staff who are less familiar with green management approaches, keep in mind it will be necessary to introduce them to a new mindset which takes into consideration a healthy living environment as well as onsite energy, resource and water use.

Training the team

Once formed, the team's first task will be to access training so they can become better acquainted with the basic principals and best practices that characterize green asset management. Training will also help members from a variety of different roles establish a common language and perspective, allowing everyone to operate from the same page. You will find a number of resources are available to address a variety of training needs.

Many gas, electric and water utility companies across the U.S. offer no- or low-cost workshops on a variety of green building topics. These classes typically run anywhere from one to eight hours and are a great way to introduce team members to green building practices without having to commit large amounts of time and money to a more rigorous credentialing program.

Online webinars and training videos are another inexpensive and flexible way to bring team members up to speed. A list of organizations offering online training resources is located in [Section 3.9 \(p. 24\): Online Training, Building Science and Green Resources](#). *(Continued on page 18)*

Green Communities Retrofit Fund Data Collection

Information Requested from Property Owner

PROPERTY INFORMATION	
Name	Street Address
OWNERSHIP/FINANCIAL INFORMATION	
Owner program requirements	Using replacement reserves to fund rehab?
Tax credit year	Previous cap needs assessment document?
Three (3) largest financing sources	Current replacement reserves
Planning to refinance and/or resyndicate?	Other financial information here?
BUILDING INFORMATION	
Year built	Common area square footage
Year of most recent rehab	Residential area square footage
Total number of buildings	Number of floors
Building type	Number of primary building entries
Total building square footage	
UNIT INFORMATION	
Total number of units	Average number of occupants
Number of occupied units	Unit size (no. of bedrooms)
Unit population (e.g. children, elderly, supportive)	
AVAILABLE INFORMATION	
As-built drawings	Reasonable escorted access to facility/apts
Current equipment schedule	Contact information for project personnel
Recent photographs of building	Operations & Maintenance plan, schedule
Previous energy or Wx audit	Resident manual
Previous energy or Wx measures installed	
UTILITY INFORMATION	
Electric utility provider & account no.	Heating oil provider & account no.
Natural gas utility provider & account no.	Solid waste (garbage) provider & account no.
Water utility provider & account no.	Other provider(s) & account no.(s)
FUEL MIX/PAYMENT OBLIGATIONS	
Is electricity central/individually metered	Is water central/individually metered
Number of meters	Number of meters
Meter numbers	Meter numbers
Is gas central/individually metered	Heating oil central/individual paid?
Number of meters	Solid waste (garbage) disposal
Meter numbers	Other

(Green Communities Retrofit Fund Data Collection, Continued)

COMMON AREA AMENITIES	
Elevators	Commercial kitchen
Central laundry facility	Incinerator
Refrigerated vending machines	Trash compactor
Retail or commercial space	Property manager apartment
Community space	Other amenities (those that may consume electricity and/or water)
Offices	
BUILDING ENVELOPE	
Ceiling heights	Basement/crawl space insulation
Roof composition	Previous upgrades?
Floor composition	Windows
Attic insulation	Doors
Exterior wall insulation	Tenants complaints about drafts?
Basement or crawl space	
SPACE HEATING	
Owner or tenant pays?	Condition, age of equipment
Fuel type(s)	Previous upgrades?
Equipment type	Average indoor air temperature
Distribution type	Controls
Areas serviced	Tenant complaints about comfort?
SPACE COOLING	
Owner or tenant pays?	Condition, age of equipment
Fuel type(s)	Previous upgrades?
Equipment type	Average air temperature
Distribution type	Controls
Areas serviced	Tenant complaints about comfort?
VENTILATION	
Does mechanical ventilation exist in building?	Ducts sealed, insulated?
Equipment type	Previous upgrades?
Distribution type	Controls
Areas serviced	Bathroom ventilation
Condition, age of equipment	Range hood ventilation
Combustion appliances tested?	
DOMESTIC HOT WATER	
Owner or tenant pays?	Condition, age of equipment
Fuel type(s)	Previous upgrades?
Equipment type	Controls
Distribution type	Hot water pipes insulated?
Areas serviced	

SECTION 3: ESTABLISHING A FOUNDATION AND FRAMEWORK

(Green Communities Retrofit Fund Data Collection, Continued)

WATER USAGE	
Owner or tenant pays?	Plumbing fixtures
Equipment type(s)	Previous upgrades?
Condition, age of equipment	Landscaping
LIGHTING	
Interior common area fixtures and bulb type	Operating schedule
Operating schedule	Controls
Controls	Previous upgrades?
Exterior fixtures and bulb type	
COMMON AREA APPLIANCES	
Refrigerators	Laundry
Ranges	Previous upgrades?
INDOOR ENVIRONMENTAL QUALITY OCCUPANT HEALTH & SAFETY	
(from Healthy Housing inspection manual)	Client health questionnaire
Changed heating filters every 3 months	Tenant synopsis
Radon mitigation/venting	Carbon monoxide measurement in ambient air
HVAC equipment serviced within past year	Combustion gas Leak testing
Presence of pests (e.g. mice, rats, bugs)	Inspect for mold and moisture damage
Pest control mechanisms	Identify potential fire hazards
Where are pets allowed to go?	Inspect for faulty, inadequate or dangerous wiring
Lead paint	tested smoke alarms, CO monitors
Asbestos	Verify pressure relief valves on hot water tanks and boilers
Tobacco smoke	Record and properly document test results and observations
Cleaning practices and frequency (e.g. sweep, vacuum)	

If you are looking for a more in-depth approach to training, the Credential for Green Property Management (CGPM) program is offered by the National Apartment Association (NAA) and the National Affordable Housing Management Association (NAHMA). Those trained through this set of courses will learn the latest techniques and technologies for making cost-saving green improvements at their properties, and receive instruction on a variety of green building operations and management topics. CGPM staff

certification also provides a gateway to additional programs and resources. For example, CGPM is required for participation in HUD's Green Initiative program. It also supplies management companies and owners participating in the green Mark-to-Market (M2M) program with a mechanism for meeting the initial and ongoing training requirements of the HUD Office of Affordable Housing Preservation (OAHP).

Once basic training is completed, the team will need to learn about data collection and analysis. These skills are critical to your team's success. The best way to provide concrete evidence that your projects and improvements are making a difference is by measuring performance before, during and after implementing the modifications you have chosen. These measurements, and the appropriate interpretation of them, will require your team to collect relevant data, document it and statistically analyze any change. If the change is positive, then your team will have data-supported validation for the investments that have been made; if there is no change, or the change is in a negative direction, the team will have detailed information on what needs to be adjusted in order to achieve your desired results.

Step 2: Understand Existing Conditions and Assess Performance

Tracking such change reflects recent trends in green housing, as the field becomes more anchored in data-driven validation of the benefits inherent in a green approach. You can contribute to documentation of the effectiveness of green management practices by making sure you consistently assess performance. This involves the precise measurement of improvement or deterioration in areas such as resource consumption, indoor air quality and waste management.

The first step is to establish a baseline against which you can measure future change at your site, and thus you will need to start by documenting the existing status of (a) building characteristics and (b) management practices. This involves collecting data that records performance in these three areas

over a period of time so that an accurate picture can be captured.

To create a profile of your building, pull together a spreadsheet or database of the information contained in the text box below over the span of 12 months (and three years is ideal):

The second category, management practices, involves a number of different factors. You will need to include information on the following factors pertaining to performance over the period of 12 months for this part of your baseline profile:

- Utilities – specifically energy and water consumption
- Waste
- Turnover

Perhaps the most important of these factors is energy and water consumption, since these account for a large portion of building operating costs and thus offer some of the highest cost savings potential. At minimum, all energy and water sources should be accounted for, including electric, natural gas, propane and onsite generation (such as electricity generation through photovoltaic¹ systems or wind turbines).

There are several approaches to collecting data and establishing a baseline for energy and water consumption. An energy and water audit collects information about existing building and mechanical system characteristics. This information can be used to identify cost-effective upgrades that will improve overall performance. A more complete discussion on the topic of audits can be found in [Section 3.4 \(p. 11\): Performance-Based Substantial Rehabilitation](#). Benchmarking

¹ The use of solar cells in converting sunlight into electricity

buildings is useful in comparing water and energy performance among buildings within a complex or a portfolio, identifying under-performing buildings and prioritizing energy and water investments.

The “Benchmarking” subsection, Section 4.28 (p. 54) offers more information on the subject of Benchmarking.

In any case, you will need to collect cost information related to energy and water usage for a period of at least 12 months. Utility bills are the most basic form of energy and water usage data and can often be made available at both a property-wide and a household-by-household level.¹ Master-metered energy and water use data is the most widely accessible and is most likely to impact operational costs when utility bills are paid by the building owner or management. More detailed data from sub-meters can reveal where specific use is occurring. In individually metered multifamily buildings, collecting resident utility bills will require obtaining resident utility release forms. See [Appendix B \(p. 89\)](#) for an example release form. Because of this, you may find that in such situations the data set for a whole building or complex may not be complete. Having a sample of data from a subset of individual units is still useful when starting out. Some tips for data collection include:

- Have residents sign a utility release form when they sign the lease.

¹ www.energystar.gov/index.cfm?c=assess_performance_gather_data

- Collect data by fuel type and from sub-meters, if feasible.
- Use actual – not estimated – data whenever possible.
- Use the most current data available, preferably one year or more of monthly data.

This data set should improve your understanding of the property’s energy and water use as it contributes to operational costs, as well as provide a solid base of information on which to base future decisions concerning improvements to the building and the site. In order to pinpoint which building components and practices are contributing most to energy and water use, and which upgrades will be most cost effective, you can arrange for technical

audits of various systems and equipment that will provide the supplemental information you need.

Once energy and water consumption data have been collected

and a baseline established, the next step is to set up a monitoring system to track performance moving forward. This will provide the means for measuring improvement and progress toward green management goals. Be sure to use a tracking system that can easily generate periodical reports profiling energy and water performance. An ideal performance tracking system would include:

- Energy Use Intensity (EUI) (annual energy per square foot)
- Energy cost per square foot, separated out by fuel type (e.g., gas vs. electric)

- Water Use Intensity (WUI) (annual water per square foot)
- Water cost per square foot (both indoor and outdoor)
- Greenhouse gas emissions (million metric tons of Carbon equivalent)

As mentioned in [Section 4.27 \(p. 53\): Materials](#), the EPA's Portfolio Manager is a good option for tracking performance data. It is widely used, simple and free. The reports that are generated will offer your team concrete evidence of the result of their efforts, while also providing necessary information for identifying areas in which further performance improvements can be made. The reports can also be used to communicate ongoing progress to building staff and residents, encouraging all participants to think about green choices, efficiency and conservation. An example of effective and creative communication with residents can be found in [Appendix C \(p.90\)](#). "The Central Park Energy Flyover" is intended to provide residents with an overview of their energy usage by unit along with tips for energy reduction and key contact information for building-related issues.

Step 3: Set Goals

When the team has gained a comprehensive understanding of the property's current performance as reflected in the building performance profiles described above, the next step is to set parameters and green goals that include both usage levels and cost savings. Having the whole team participate in the activity of setting

goals encourages each individual to develop a vested interest in achieving them, thus increasing your chances for success.

The first step in this process is to estimate the potential for improvement in each area. Once this is established, you can then move on to set targets that are:

- Realistic
- Specific
- Measurable
- Time dependent

As many managers know, setting incremental goals can be very helpful in facilitating consistent progress, as this process allows the team to consider both short-term and long-term issues as they make decisions about implementing various

projects. Incremental goals help create an overall vision for the project, encourage momentum, and ensure immediate decisions do not

hinder opportunities for further improvement and deeper savings. Short-term goals may focus on a specific rehab project or a year of improved operations and maintenance protocols, while long-term goals are broader and address the lifecycle of a building. Long-term goals can address a property's performance over 5 to 30 years and may include multiple rehab and retrofit projects, as well as operations, maintenance and tenant behavior.

By taking into account factors such as the vintage of the building and its systems and the magnitude of any planned rehabilitation, you will be able to identify appropriate goals that correspond with the level of resources available to you. For example, if the project is receiving Low-Income Housing Tax

Set targets that are realistic, specific, measurable, and time dependent.

Credit funding for a rehabilitation, a reasonable short-term goal may be achieving a 15-20 percent improvement in existing levels of energy and/or water use. Enterprise's 2008 Green Communities Criteria requires that moderate and substantial rehabilitation projects achieve a 15 percent improvement in energy performance over pre-rehabilitation building performance. If, however, your project scope does not include an aggressive rehabilitation approach and your current budget allows for only minor changes, consider a less aggressive goal, such as "The ENERGY STAR® Challenge," which is a national call-to-action to improve the energy efficiency of America's commercial and industrial buildings (including multifamily properties) by 10 percent or more.

Long-term goals, on the other hand, may involve reducing energy or water consumption by 40-60 percent over 30 years, or even bringing net energy use to zero by installing renewable energy systems to fulfill the site's remaining energy needs after the team has exhausted all available energy efficiency options. A consultant specializing in green building, energy or water management can also provide helpful guidance concerning what it will take to meet different thresholds of reduction in your specific situation.

Similar goals can be set for improving indoor air quality, reducing greenhouse gas emissions, and any other health or resource issue important to the team. These goals can be applied to a single residential project or to a portfolio of buildings.

Once the team has identified and agreed upon specific goals, it's time to create a schedule and set

milestones for measuring progress. The team will then need to develop a communication plan, as sharing the progress achieved through everyone's hard work is an integral part of creating a sustained cooperative effort. These steps are explained in more detail in the following section.

Step 4: Create an Action Plan

With goals in place, the team's next task is developing a road map for achieving them. You can begin by identifying some detailed technical steps that will take you in the direction of your established goals. Take a look at the data analyses you carried out in Steps 2 and 3 and ask which areas are most in need of improvement—electricity, gas, water or perhaps another resource? What measures can help you improve in those areas?

Once you have decided on these objectives, the next step is to create a timeline and a system for tracking your progress. If the team is working on a specific retrofit or rehabilitation project, [Section 5 \(p. 59\): *Developing a Plan For Building Upgrades*](#) can help you define the scope of your project and develop an appropriate action plan.

At this point, the team will need to assign clear roles to individual members and allocate responsibility for achieving each goal. This is a good time to identify those tasks that require the involvement of professionals outside the green asset management team, experts such as consultants, contractors and vendors whose knowledge and skills are essential to the project's success. By establishing your own criteria for evaluating people or companies that could potentially fill these roles, you can ensure that appropriate levels of expertise are accessed.

Next, the team should estimate and evaluate the cost of each item involved in the project. Cost analysis tools can be found in [Section 3.10 \(p. 25\): *Methods of Cost Analysis*](#). Once all the expenses are defined, you will be able to identify any financial need and develop a business argument to help secure funding for the project and maintain an ongoing commitment from your supporting organization. More information about financial resources can be found in [Section 5.9 \(p. 69\): *Identifying Financial Resources*](#).

Step 5: Implement the Action Plan

Finally, it's time to put your plan into action! You have laid the groundwork for a solid and effective course of action, and now the team can begin to implement its well thought-out program for bringing green asset management on board.

Balance would appear to be the key factor during this stage of the project. After all the work that went into developing your goals, objectives and timeline, you will want to follow your plan carefully, adhering to your budget and your schedule in order to keep costs under control. However, the reality is that implementing change always involves some unanticipated events, and therefore flexibility is required. An open line of communication among team members is essential, as regularly updated progress reports can inform any adjustments to goals and plans that might be needed to overcome unforeseen barriers. Regularly scheduled meetings for following up on implementation progress, addressing challenges and celebrating successes can ensure a forum is provided for detailed information exchanges and timely discussion.

Step 6: Evaluate Progress

It is essential that the team consistently track its progress using the tracking systems set up in Steps 2 and 4. Doing so provides concrete data on the results of your efforts and can help pinpoint areas that need further intervention or a change in approach. Depending on the scope of your plan, you may also choose to continue evaluating your progress after the implementation phase is complete.

The tracking system will allow you to record any improved performance resulting from the steps you have taken and measure it against the targets set by the team. In combination with reviewing the action plan, it will give you a clear picture of what is working and what is not. You can then use this information to make any needed adjustments to the rest of your action plan as you move forward.

Additionally, keeping such a track record provides the basis for recognizing jobs well done. Rewarding efforts and achievements can take place at a variety of different levels with recognition of an individual team member, the team, a resident, the project itself or the portfolio as a whole. The amount of support for ongoing and future projects generated by expressing appreciation of individual and team efforts cannot be underestimated, so be sure to acknowledge successes and the people behind them.

3.8 TOOLS

There are more than a few useful tools available to help your green asset management team reach its goals. Those listed here offer guidance on how to walk through the steps explained in this section of the manual. They will provide the structure you need to set up your own energy management plan and carry out an evaluation of your current practices.

Guidelines for Energy Management Overview

Follow these step-by-step guidelines, available through ENERGY STAR®, to set up an energy management plan for your organization or project.

→ www.energystar.gov/index.cfm?c=guidelines.guidelines_index

EPA Energy Management Tools

Once your asset management plan is in place, use the Energy Program Assessment Matrix to compare your energy management practices with those outlined by the Environmental Protection Agency in the Guidelines for Energy Management.

→ www.energystar.gov/ia/business/guidelines/assessment_matrix.xls

For site-specific energy management, use the Facility Energy Assessment Matrix (127KB) to help evaluate management of particular facilities.

→ www.energystar.gov/ia/business/guidelines/Facility_Energy_Assessment_Matrix.xls

Residential Data Collection Worksheet

This PDF, composed by the state of New Jersey, is a checklist for gathering utility data in residential buildings.

→ www.state.nj.us/treasury/taxation/pdf/pamsvol/datacollectionwrk2.pdf

Evaluating Options and Creating an Action Plan

The last several pages of Local Initiatives Support Corporation's (LISC) Green Rehabilitation of Multifamily Rental Properties offer a chart to help you prioritize and schedule project upgrades, as well as assign responsibilities. This tool suggests specific measures and helps define your plan of action.

→ www.fypower.org/pdf/GreenRehab_MultiFamily.pdf

3.9 RESOURCES

The resources below provide information for your green asset management team on training programs, data collection, and utility tracking.

Online Training, Building Science and Green Resources

Enterprise Community Partners

→ www.practitionerresources.org/documents.html?c=312

U.S. Environmental Protection Agency

→ www.epa.gov/greenbuilding/

USGBC, Greenbuild365

→ www.greenbuild365.org/coursecatalog.aspx

California Integrated Waste Management Board

→ www.ciwmb.ca.gov/Greenbuilding/Training/State.htm

BuildingGreen.com

→ www.buildinggreen.com/menus/topics.cfm

Sustainable Buildings Industry Council

→ www.sbicouncil.org/displaycommon.cfm?an=1&subarticlenbr=3

Housing California

→ www.housingca.org/events/

Credential for Green Property Management (CGPM)

The NAHMA credentialing program for property and building managers focuses on green building principals and practices. Applications and a list of approved green credential training providers can be found on the NAHMA website.

→ www.nahma.org/content/greencred.html

ENERGY STAR®: Gather and Track Data

This webpage outlines the basic steps and considerations for gathering utility data.

→ www.energystar.gov/index.cfm?c=assess_performance.gather_data

Additional Resources

How to Read Your Utility Bills: Conservation Consultants, Inc. PA

This article defines terms commonly found in typical utility bills, outlines steps for contacting most utility companies and offers tips for conserving energy in the home.

→ www.ccicenter.org/archives/28

Key Tips on How to Read Your Utility Bills: California Public Utilities Commission

This webpage also provides definitions of key utility billing terms and explains how energy use in the home is calculated.

→ docs.cpuc.ca.gov/published/Report/8526.htm

3.10 METHODS OF COST ANALYSIS

Many building owners view energy and water costs as hopelessly escalating factors when in reality, it is possible to regulate expenses in these areas by upgrading to more efficient appliances and infrastructure. The key to effectively managing utility costs lies in deciding which upgrades yield true savings, a task that can be made simple when the appropriate cost analysis tools are used.

Traditional financial metrics such as Return on Investment (ROI), Internal Rate of Return (IRR), and simple payback are effective for prioritizing most capital budget investments, but different methods must be used to calculate energy costs and savings. This is because traditional formulae are not equipped to identify and factor in the energy savings and return on investment that result from energy-efficiency upgrades. Instead, they tend to focus on the costs involved, undervaluing the potential financial benefits inherent in energy efficiency-projects. Unless the operating dollars saved by the installation of a new system are properly reflected in cost-analysis calculations, energy-efficiency projects can be inadvertently penalized by their greatest benefit – improving cash flow.

Thus, traditional metrics alone will not help you arrive at an accurate comparison of your investment in a project and your anticipated savings over time. For example, your team may have identified problem areas in utility usage at a specific site and want to assess the cost effectiveness of implementing energy-efficiency upgrades. For this assessment to be accurate, it will need to include the cost savings that will result from lower utility bills after the upgrades are installed. ROI or IRR

calculations will not demonstrate the ongoing energy savings of 30 percent or more (according to ENERGY STAR®)¹ that over time will yield enough money to cover the initial investment needed to purchase the upgraded appliances. That's why the team will need to use formulae that are a better match for this kind of investment scenario.

One tool is more appropriate for cost analyses related to energy-efficiency investments. This is Net Present Value (NPV), which allows the user to pick a required rate of return as part of its calculations. A more detailed description to this method follows, along with links to the actual calculation tools.

Net Present Value (NPV)

Net Present Value measures increases in the value of an investment based on an

organization's required rate of return. It takes into account factors such as equipment life, the risk level of the investment and the length of time until the energy or water savings will be delivered. It is simple to compute the NPV formula, but you can choose to have the calculations worked out for you by using a spreadsheet with an NPV function. The risk of the project is taken into account when you select an appropriate discount (hurdle) rate for the investment. If the sum of the present values of the

expected annual energy savings is greater than the initial energy investment, the NPV of the project will be positive and should be undertaken.

Net Present Value (NPV) = Initial Investment + Sum of the Present Values of the Estimated Energy or Water Savings (Life of the Project)

Communicating and Implementing Cost Analysis Results

Competition for capital dollars is always fierce, especially in a down economy when capital projects tend to be cut. One of the most frustrating

The question becomes: How can future operating budget savings pay for energy efficiency improvements today?

The answer is: By dedicating the resultant savings in future monthly utility bills to cover payments on upgrades and improvements.

experiences for asset managers can be hearing that a green project will be postponed or denied because "it's just not in this year's budget."

When it comes to energy efficiency and water conservation, the reality is often just

the opposite green upgrades can make a substantial contribution to improving operations budgets.

Such resistance often comes from owners who assume their capital budget will be tapped to provide financing to your project, when in fact, that is not the case. At these times, it is the team's job to demonstrate how your project does not need to compete for capital dollars because in the long term, funding will come from saved utility costs.

You can draw a clear distinction between typical capital investments and green initiatives by pointing out the ways in which the financing differs. For

¹ Article written for publication of the National Electrical Manufacturers Association (NEMA), February -2009 www.energystar.gov/ia/partners/spp_res/NEMA%20Article%20Feb%202009.pdf

example, ROI implies using cash on hand and investing it in a project. However, energy efficiency and water conservation projects can be financed and structured to ensure that their monthly payments are less than the amount gained each month in the energy savings that will ultimately be realized. Under these conditions, it will become clear that the project will truly pay for itself.

The question becomes: How can future operating budget savings pay for energy-efficiency improvements today?

The answer is: By financing the project initially, and then dedicating the monthly savings in utility costs that result from your improvements to cover payments for the original outlay. Thus, it is critical to ensure that decision makers use NPV or ROR to calculate project expenses so they can see this reality reflected in their number crunching.

When discussing financing options, your team may also want to consider selling the carbon offset credits associated with additional energy efficiency upgrades. While all U.S. carbon offset trade is currently voluntary, a variety of carbon trade vehicles have already been established, such as the Chicago Carbon Exchange, the Regional Greenhouse Gas Initiative in the Northeast, and the Western Climate Initiative (a collaborative trading relationship between seven U.S. states and four Canadian provinces). Enterprise offers an innovative offset fund as well, The Green Communities Offset Fund, which only purchases offsets from green affordable housing development.

Realized Cost Savings

Once your team has worked through its action plan and implemented the desired changes, will their job be complete? Hardly! Putting those newly acquired appliances, infrastructure and/or management practices into use is just the beginning of your venture into green asset management. Achieving optimal levels of green management is an ongoing commitment, one that extends beyond the final delivery date of any specific implementation. Even as your team celebrates the successful completion of a project, it's a good idea to bring into focus the long-term requirements of a green approach.

Whenever new buildings are constructed or existing developments undergo major retrofitting, a building performance assessment is almost always carried out. However, once buildings become occupied, it is not uncommon for these assessments to be forgotten or disregarded, even though doing so risks the significant savings that can be achieved through diligent monitoring. Therefore, be sure your team maintains a long-term perspective and understands that ongoing monitoring is just as important as project implementation. The benefits of green asset management can only be fully realized as your team continues to pursue building performance goals and make progress on the items identified in your performance assessment. More information on the subject of monitoring can be found in [Section 4.28 \(p. 54\): Monitoring](#).

3.11 NON-MONETARY COSTS

Up to this point we have been examining the financial costs involved in evolving your asset management approach into a greener process. However, beyond the items that can be easily translated into monetary value are other, more intrinsic factors affecting owners and occupants alike, including some that impact the environment. These non-monetary qualitative costs, both internally and externally oriented, can impact lifestyle, economics and the natural aesthetics of our world. While many of these costs are indirect, they do have value in terms of influencing health and comfort, increasing market appeal, reducing greenhouse gases, conserving natural resources and promoting environmental leadership.

Beyond those positive consequences of green asset management that can be easily translated into monetary value are other, more intrinsic factors affecting owners and occupants alike, including some that impact the environment and even the planet itself.

Health and Comfort

Healthy homes help keep people well, which enhances each household's standard of living and increases attendance rates and productivity at work. The increase in cash flow to individual residents from utility and other savings raises the probability that rents will be paid when due.

Furthermore, comfortable homes attract a tenant base that appreciates the value of a healthy and enjoyable environment, while ultimately yielding fewer complaints and calls to building management. Finally, aesthetics cannot be overestimated as an important factor impacting housing choice. Green adds value to a home because residents find it a more satisfying, healthy and comfortable place to live.

Environmental Stewardship or Leadership

Environmental stewardship can provide the means to secure valuable publicity for your project and your organization, as well as an opportunity to demonstrate leadership in the greater community. Such leadership makes projects and organizations more competitive when it comes to securing grant money, tax credits and other funding resources. Publicity also attracts potential employees, increasing the caliber of applicants and talent available to you. Whether or not these influences immediately affect your bottom line at the project level, they do play a role in the overall success of an organization and should be included as critical factors in the decision to green a portfolio.

3.12 TOOLS

Typically, building owners initially choose cost as the metric of choice when determining whether or not to invest in green measures such as energy and water efficiency. This section provides information on tools developed by Heschong Mahone Group that are commonly used by commercial building owners to evaluate the productivity of their investments. Oftentimes, one or more of these metrics are applied to gain information on whether an investment is equal to or greater than the company's minimum requirements. You can also

use them to obtain comparisons of various options in order to identify the best investment strategy.

Return on Investment Calculator

This cost analysis tool allows for the simultaneous calculation of simple payback, Return on Investment, Net Present Value and Internal Rate of Return for several upgrade scenarios. The summary sheet provides a table for a basic comparison of the upgrade packages.

ROI Calculator for Energy Efficiency Projects

→ www.greencommunitiesonline.org/tools/documents/roi_calculator.xls

3.13 RESOURCES

The following resources provide additional information on methods of cost analysis, financial justification of green upgrades and long-term analysis.

Payback Period Evaluation

This page of the U.S. Department of Housing and Urban Development website provides a simple explanation of how to calculate a payback period without the assistance of a payback calculator tool, accompanied by helpful examples.

→ nhl.gov/offices/cpd/affordablehousing/training/web/energy/cost/calculation.cfm

Life-Cycle Cost Analysis (LCCA)

Sieglinde Fuller, National Institute of Standards and Technology (NIST)

Visit this website for a better understanding of lifecycle cost analysis. The site offers guidance on evaluating lifecycle costs of project alternatives,

including links to several LCCA tools or calculators.

→ www.wbdg.org/resources/lcca.php

Additional Resources

Incremental Cost, Measurable Savings: Enterprise Green Communities Criteria

Enterprise released *Incremental Cost, Measurable Savings: Enterprise Green Communities Criteria*, a first-of-its-kind study showing the cost effectiveness of meeting Enterprise Green Communities Criteria, the only comprehensive green building framework for affordable housing. In summary, estimated lifetime savings exceed the initial investment made to incorporate the Enterprise Green Communities Criteria into affordable housing.

To download *Incremental Cost, Measurable Savings: Enterprise Green Communities Criteria*, visit:

→ www.greencommunitiesonline.org

The Cost of Green Revisited: Davis Langdon

This paper revisits the cost issues inherent in the incorporation of sustainable design features into projects, using Leadership in Energy and Environmental Design (LEED) credit points to define the criteria for sustainability. It builds on the work undertaken in an earlier paper “Costing Green: A Comprehensive Cost Database and Budget Methodology,” released in 2004, and takes a look at developments in recent years as sustainable design has become more widely accepted and practiced.

→ www.davislangdon.com/upload/images/publications/USA/The%20Cost%20of%20Green%20Revisited.pdf

Long-Term Investments for Energy Savings: *U.S. Department of Energy*

Long-term investments in energy-efficient products and upgrades can save you even greater amounts of money and energy in years to come. Consider the suggestions listed at this site when purchasing new products or when improving a home's energy efficiency.

→ www.energysavers.gov/seasonal/long_term_investments.html

3.14 SPECIFYING GREEN PRODUCTS

When it comes to greening existing buildings, the choices you make concerning the products you use in rehabbing, cleaning and maintaining your property can have a significant impact. In response to the demand for environmentally responsible alternatives, manufacturers have recently flooded the market with Environmentally Preferable Products (EPP). EPP refers to “products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose.”¹ Specifying EPP over conventional products promises direct health benefits for building residents, and also minimizes the risk of toxic materials exposure for the contractors and trades people working on your project.

You will find that environmentally conscious vendors have already researched the products they use and are typically quite happy to explain the reasons for, as well as the merits of, their selection.

The challenge in making smart product decisions is two-fold: 1) sorting through the criteria used to evaluate a product's attributes, and 2) subsequently

determining which products align with the overarching green goals of the project. Fortunately, there are several product certification and listing services that can inform your

decisions about which products will prove the most beneficial. The best process for this task is the independent, third-party verification of a product, which ensures that conflict of interest has not tainted its certification.

Information on national product certifications is easily located on the Internet, and websites often include specifications you can use as reference points while you look for and compare matching products. If you prefer to source products locally, one option is to contact the manufacturer of a specific product and ask for a local contact or retailer. Usually manufacturers are more than happy to identify which companies and stores sell their products in any given geographic area.

If your organization hires vendors to provide cleaning, pest control, construction or other services, you can include questions about the products they use as part of your initial fact-finding checklist. The best time to

¹ Presidential Executive Order 13101, September 1998.

raise the issue of green products is at the start of your vendor search so it can become part of your selection criteria. However, there is no reason to hesitate in asking about the environmental impact of a vendor's products, even if you have engaged them for years. You will find that many vendors have already researched the products they use and are typically quite happy to explain the reasons for, as well as the merits of, their selection. In addition, those vendors who have been less aware of the environmental and health issues involved in their choice of products may be prompted by your inquiries to carry out some consumer research and revise their choices.

Along with making the decision to select green products and vendors, consider giving new life to any unwanted materials you may have onsite. Before demolishing or tearing out components in an apartment, look for opportunities to remove and recycle them instead. Building deconstruction, which refers to the careful disassembly of a building in order to salvage materials for reuse, has been shown to be more cost effective than demolition when landfill disposal costs and potential income from salvage are taken into account.¹ The salvaged building materials may either be used on new construction and rehab projects, or sold to a building supply store specializing in discounted used materials (see Habitat for Humanity's Re-Stores or other local nonprofit organizations). The use of salvaged building materials decreases the amount of construction waste associated

with a project by reducing the need for newly manufactured materials and by limiting the amount of demolition by-product sent to landfills.

3.15 TOOLS

EPA's Environmentally Preferable Purchasing Tool Suite

This section of the EPA's site, under the sub-heading "Building and Construction," provides links to and information on decision-making tools for building material and product selection, including screening criteria based on social justice issues.

→ www.epa.gov/epp/tools/index.htm#b

3.16 RESOURCES

The resources listed in this section will help you understand green product criteria and certification, as well as locate green products and vendors.

Behind the Logos: Understanding Green Product Certification

This article provides information on green product certifications.

→ www.buildinggreen.com/auth/article.cfm?fileName=170101a.xml

Healthy Buildings Network

You can go to this site to learn how careful selection of building materials can reduce environmental health threats from toxic chemical emissions. Their newsletter archive is a great place to find tips on selecting green building materials.

→ www.healthybuilding.net/

¹ "Building Deconstruction: Reuse and Recycling of Building Materials" by Bradley Guy, available at www.lifecyclebuilding.org/files/Six%20House%20Building%20Deconstruction.pdf

Green Vendor and Services Directory

The Northeast Recycling Council has assembled this list of vendors who provide green products and services across the U.S.

→ www.nerc.org/documents/green_purchasing/adtnlgrnvndrs.html

Online GreenSpec Directory

This site provides a product-listing service that houses more than 2,000 environmentally preferable products. Each product description includes contact information for the manufacturer and lists aspects that qualify the product as green. A hard copy of the directory can also be purchased from the Building Green website.

→ www.buildinggreen.com/menus/index.cfm

Additional Resources

Product Certification and Accreditation

Carpet and Rug Institute's Green Label/Green Label Plus

→ www.carpet-rug.org

Cradle-to-Cradle – general: lifecycle assessment

→ www.c2ccertified.com

EcoLogo – general: public environmental certification

→ www.ecologo.org

Forest Stewardship Council – wood

→ www.fsc.org

Greenguard: indoor air quality

→ www.greenguard.org

Scientific Certification Systems – general: recycled content, IAQ, lifecycle

→ www.sccertified.com

FloorScore – flooring

→ www.rfci.com

Home Depot Eco Options program

For suggestions on do-it-yourself green projects along with more intensive renovation work that can improve the performance of your home, visit this section of Home Depot's website. You can also look under specific environmental performance goals (water conservation, energy efficiency, etc.) to see which applicable products are typically carried in Home Depot stores.

→ www6.homedepot.com/ecoptions/

Green Seal

An independent nonprofit organization dedicated to safeguarding the environment and transforming the marketplace has developed this site to promote the manufacture, purchase and use of environmentally responsible products and services.

→ www.green seal.org

3.17 BUILDING PROFESSIONALS AND QUALITY ASSURANCE

If your action plan for green improvements involves work of a more substantial nature, you may want to call on the specialized expertise of a green building consultant. Your choice of consultants and contractors plays just as big a role in your success as your carefully laid plans, and thus it is important to invest an equivalent amount of time and effort

in selecting these professionals. This section of the manual is designed to help you make smart hiring choices. It addresses timing and scope of work for each type of professional, and describes some of the issues that arise when outside consultants are brought in.

3.18 BUILDING PERFORMANCE (ENERGY AND WATER) CONSULTANT

The role of a building performance consultant is to assess existing systems and use building science strategies to make cost-effective recommendations concerning equipment upgrades and operational changes. The purpose is to help you gain the greatest savings and efficiency at the lowest cost. This is not meant to be an ongoing service, but rather is best performed periodically.

Approaching an Energy Consultant

Given the wide range of energy consultant practices now available, it is worthwhile to consider what type of energy consultant would best serve your individual project. Typically, energy consultants are used to evaluate retrofit measures as part of a substantial rehabilitation. However, they can also act as valuable resources for identifying smaller prescriptive upgrades, and are able to run code compliance documentation if a building permit is required. Some energy consultants specialize in code compliance for new construction, or are trained mechanical engineers specializing in HVAC systems. The energy consultant most likely to be a good match for the needs of a your team, however, would be someone with experience in energy auditing and the analysis

of existing multifamily buildings. In many parts of the country these particular types of energy consultants also include HERS rating as an integral part of their business, and are therefore familiar with some of the more pragmatic issues involved in maintaining a building.

The Role of an Energy Auditor

The role of an energy auditor is two-fold: 1) to conduct visual and diagnostic testing of existing buildings, possibly including infiltration and duct leakage testing, and 2) to verify the proper installation of energy measures through visual inspections and diagnostic testing. Practitioners that are HERS raters and/or Building Performance Institute's (BPI) building analysts have attained professional certifications that demonstrate an understanding of evaluating a building's energy performance. These professionals are often called in when major energy renovations are planned, as they can effectively support building performance contractors with field testing and inspections.

HERS raters and/or BPI building analysts should typically be hired prior to the development of an asset management or rehabilitation plan, so they can provide inspection and benchmarking of existing buildings in their pre-greened state. The results of these analyses will provide concrete input for your team's project selection process, as well as baseline data for comparison with post-implementation performance levels. A HERS rater and/or BPI building analyst's independent verification that energy efficient design features have been fully executed during building

improvements can also be crucial in converting potential energy savings into real energy savings. As a third-party inspection, it should follow the installation phase of a rehabilitation plan, thus providing assurance to owners that the measures they specified have been installed and are, in fact, functioning at the intended performance level.

Selecting a HERS Rater Appropriate for the Project

The role of HERS raters has expanded in recent years, and now HERS documentation is required for a wider range of functions: home energy auditing, federal tax credit documentation, energy-efficiency mortgages, benchmarking, etc. If your project is participating in a national or local green building program, it is important to ensure that the HERS rater you choose is certified to inspect for that specific program.

You can easily identify your specific program and inspection requirements prior to selecting a HERS rater. The following questions will help define your needs and guide you to a rater experienced in the appropriate areas.

- What is your building type (low-rise, mid-rise or high-rise)? Multifamily is a specialty, so if it applies to your property, be sure to find a rater well-versed in this unique project type.
- Do you need an energy audit? Would you like the building(s) benchmarked?

- What types of diagnostic testing are necessary (Blower Door/Infiltration, Duct Testing, Adequate Airflow, etc.)? Not all raters have the certification and the equipment to conduct all diagnostic tests.
- Would you like energy simulation modeling or analysis included in the scope of work? If so, be sure to inquire about the software used and its capabilities and limitations, in order to keep your expectations realistic.
- Do you need energy code compliance documentation to secure a permit for the project?
- Are you participating in any programs or applying for funding that requires special HERS inspections or certifications?

3.19 GREEN BUILDING CONSULTANT

For substantial property rehabilitations, a green building consultant will typically join the green asset management team as an advisor. The role of

Green building consultants can help develop goals before you become locked into choices concerning rehab measures, and can bring the team to a common understanding of what will be expected of them.

a green building consultant can vary considerably from project to project, depending on the extent of a project's green goals and the design team's prior experience with green projects. These consultants

can help develop green building goals before a team becomes locked into choices concerning the type and extent of their rehab measures, and can bring the team to a common understanding of what will be expected of them. After the initial green goals have been set, a green consultant will usually become more focused on the analysis of

specific green building methods and materials and coordinate closely with the rest of the asset management team.

The role of the green building professional can be similar to that of a building performance analyst or a HERS rater, in that each of these professionals (a) diagnose and identify opportunities for use of green building methods and materials, and (b) recommend operations and maintenance procedures that are less harmful, use fewer resources and encourage re-use. However, green building consultants also may have expertise with the verification requirements associated with a holistic green building certification program, whereas an energy expert may be solely focused on the testing and analysis required to determine and improve a building's energy performance. The green building consultant is typically the team member responsible for overseeing healthy living issues, resource and water conservation analysis and sourcing options for green materials. Green building consultants should be called in during the rehabilitation phase of a project, or to assist with a review of current operations and maintenance procedures to assess their level of green performance.

3.20 ARCHITECT/DESIGN CONSULTANT

Spatial, structural and/or aesthetic changes related to a major renovation may require the use of an architect or designer. Integrating these changes with decisions that affect energy, water and resource efficiency and conservation is critical to successfully greening a project. If you decide to bring in an architect or designer, make sure these professionals

meet regularly with the energy or green building consultant, as well as the rest of the green asset management team, to be certain a common vision is realized by all.

3.21 ENGINEERING CONSULTANT

The engineering consultant's role is to design high performance mechanical systems, such as those for heating, cooling, ventilation and water distribution. You will want to find an engineer that has experience in maximizing efficiency, and be wary of engineers relying on rules of thumb, as these rules are often created to avoid tenant complaints but do not offer the most energy-efficient solution. An engineering consultant should be included in meetings with the asset management team, the architect and the energy or green building consultant to ensure all specialties are integrated and working toward a common goal.

3.22 HIRING A CONTRACTOR

Most of the same guidelines that apply when selecting a general contractor for any project also apply to hiring contractors for greening existing buildings. There will be many opportunities for a skilled contractor with experience in green building to add value to the project, such as offering advice on the options and alternatives available to your team regarding building materials and systems.

For extensive retrofits, consider involving the general contractor early in the design process. Design changes in the early stages of a project are always more affordable than those made later, but if such changes are demanded later in a project (e.g., to meet budget) a skilled green contractor should

be able to minimize any negative impact on high-value green features. Even if you have decided not to hire a general contractor for your project, consider consulting with one during the design phase as it often proves worthwhile to invest in gaining vital, practical input early enough for the team to consider the full range of green design choices available to them.

This arrangement also offers additional benefits to both the general contractor and the team. The general contractor gets the opportunity to demonstrate his or her knowledge of green building, while at the same time developing an edge over competitors by gaining a deeper understanding of both the project and your team's dynamics before the bidding phase. The team, on the other hand, has the opportunity to interact with contractor candidates and evaluate their knowledge and communication skills before having to make a final selection.

3.23 RESOURCES

The resources below can help you identify and select qualified consultants based on your needs and location.

Building Performance Institute

This website describes the training, accreditation and quality-assurance programs offered by BPI and its affiliates and will direct you to resources for finding BPI accredited professionals nationwide.

→ www.bpi.org/

Engaging an Energy Consultant

This presentation by Colin Jessop at Heschong Mahone Group focuses on the role of energy consultants in the design of high-performance buildings. It also can help you understand the function of building modeling in the context of a whole-building energy analysis, and enable you to make the distinction between meeting a pre-determined set of energy options and adopting a design process specific to your building type and your particular climate.

→ www.practitionerresources.org/cache/documents/670/67081.pdf

Hiring and Working with Green Professionals - Practica Consulting

This presentation, given at West Coast Green, offers additional information on searching out and selecting experienced green professionals who will best fit your needs.

→ practicaconsulting.com/pdfs/HireWorkwithGreenBldgPros_060930.pdf

RESNET - Residential Energy Services Network

These websites introduce the HERS rating system and will direct you to resources for finding HERS professionals, energy professionals and green consultants nationwide.

→ www.natresnet.org/

→ www.resnet.us/directory/raters.aspx

Additional Resources

Green Contractors: Engineering News Record (ENR)

ENR has produced a ranking of contractors based on the volume of sustainable and green projects contributing to each contractor's earnings. The list ranks the top 100 U.S.-based contractors, both publicly and privately held, based on construction contract-specific revenue from projects that have been registered or certified by third-party organizations as following specific environmental, energy-savings or sustainability standards.

→ enr.construction.com/people/topLists/greenCont/topgreenCont_1-50.asp

Hiring an Energy Consultant: California Association of Building Energy Consultants (CABEC)

This webpage describes the benefits of hiring an energy consultant and also provides a list of certified energy consultants in California.

→ www.cabec.org/hiringenergyconsultants.php

Websites for Searching Energy Consultants by Location

The following websites provide search capabilities for locating energy consultants by zip code or state. However, these lists are not necessarily comprehensive in nature.

→ www.lowimpactliving.com/providers/Environmental-Energy-Audits---Consulting/21

→ www.consultantsregistrar.com/industrysearch/energy.html

Remodeling Professional Organization:

National Association of the Remodeling Industry (NARI)

→ www.nari.org/

What is a HERS (Home Energy Rating System) Rating?: Environmental Protection Agency, ENERGY STAR®

This resource succinctly defines a HERS Rating and the new HERS Index.

→ www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_HERS



SECTION 4 OPERATIONS AND MAINTENANCE

As we pointed out earlier, your team's successful implementation of upgrades, rehabs and other green projects is only the first rewarding step in a long-term commitment to a specialized asset management approach. While much thought and preparation goes into that initial investment, the real work starts once your new appliances, infrastructure, management practices, etc., are in place and begin operation. That is when maintaining the appropriate performance standards and procedures for your new equipment become paramount.

Consider the fact that your property's ongoing operations and maintenance costs will always greatly outweigh any initial expenditure you might have made to cover the installation of new, eco-friendly equipment and measures. Likewise, the energy and cost savings your team hopes to achieve will not be realized immediately upon the completed implementation of your action plan. Rather, your savings will accumulate as green management practices are carried out over time.

Successful implementation of other green projects is only the first rewarding step in a long-term commitment.

For these reasons, it is critical that your team dedicate themselves to focusing on operations and maintenance as issues arise and over the long term. This section of the manual provides information and resources to support you in these efforts.

4.1 MECHANICAL SYSTEMS AND EQUIPMENT

Though mechanical systems and equipment are typically the most complex objects in need of operations and maintenance, they also are the ones that come with a written manual. One way to improve efficiency in your overall maintenance

process is to make sure everyone who might need a copy of these manuals in order to carry out their duties has access to them.

Then assign team members to monitor and support the training of building managers and maintenance staff, ensuring they are educated in proper operation, maintenance and safety procedures. When staff turnover occurs, track the transition to confirm that access to instruction manuals and any necessary training occurs in a timely manner, including training on environmental awareness and an eco-friendly approach to building maintenance.

4.2 WATER HEATING

A poorly maintained water heater is both inefficient and dangerous. There are several measures that can prolong the life of a water heater, be it a central or an individual system, and these are described in detail below.

Check the Sacrificial Anode

The sacrificial anode is a metal rod inside the water heater tank that, through electrolysis, prevents the water tank from rusting. Over time, as it protects the tank, this rod wears down; if the water happens to be softened, this breakdown occurs at an accelerated rate. In order to ensure the outer tank does not begin to rust, it is important to check that the sacrificial anode has not worn away completely. To do this, turn off the water heater, close the cold water valve that allows water to flow into the water heater, and open a nearby hot water faucet to relieve pressure before opening the tank. Once the tank is open, the sacrificial anode will be apparent. If the steel wire that runs through the center of the anode is exposed, it will be necessary to replace the anode. This check should be performed every 5-8 years.

Avoid Sediment Build-Up

Sediment build-up is inevitable and decreases the efficiency of the hot water tank. As it collects, the sediment has an insulating effect which causes the heating elements to operate longer than necessary, resulting in a wasteful increase in cost and energy consumption. To counteract this and keep your water heater operating at maximum efficiency as well as prolong the life of your equipment, drain the tank regularly, following manufacturer instructions.

Be sure to begin by turning off the power supply or fuel source before draining water from the tank. Do not restore power to the tank until it has been refilled, as the pressure from heating air, rather than water, may cause an explosion.

Check the Temperature/Pressure Relief Valve

The temperature and pressure relief valve is designed to keep a water heater from exploding if either the temperature or the pressure gets too high. Since residential valves are prone to failure, you should check the valve annually as a safety precaution.

Set the Water Heater at an Appropriate Temperature

The lower the water temperature, the more energy you can save, so there is ample reward for keeping your water heater setting toward the lower end of the scale. However, if the temperature is too low, two problems can arise. First, legionella bacteria can grow in water that isn't heated to a hygienic level, and bring with it the potential for major health problems. And secondly, residents may complain about not having enough hot water if the water heater setting is too low to accommodate all needs.

Therefore, it is worth taking the time to check with your local utility provider and consult your water heater manual for guidance in determining the ideal temperature setting. If resident complaints persist, be sure to check recirculation loops and pumps for possible failures before increasing the temperature on your hot water heater.

4.3 HEATING AND COOLING SYSTEMS

The best recommendation for maintaining any kind of equipment or system is always to follow the instructions laid out in the manual; however, there are some very basic tips that can help keep most HVAC systems running efficiently, and these are described here.

Thermostats

As part of your efforts to keep energy consumption at optimal levels, adjust your building's thermostats seasonally. In summer, it is appropriate to increase the set temperature by two or more degrees, and in winter, you can lower the temperature by the same amount.

Remembering to recalibrate thermostats regularly will ensure they function properly.

Filters

Air conditioner and furnace filters should be cleaned or replaced monthly during their operating seasons. When replacing a filter, make certain it is the correct size and type for the system. Beware of filters designed with the potential for capturing more particles, as these can also cause a pressure drop that may negatively affect the efficiency of your distribution system. If you choose to use this type of filter, it will be important to work with those on your team with expertise in ventilation systems to ensure the appropriate balance for your system so that performance is not significantly compromised.

Indoor air quality can be further controlled by checking that:

- Areas next to air intakes are clean and free of dirty or toxic materials
- Ducts are clean
- Humidifiers are drained and cleaned after the heating season

Duct Testing

When it comes to optimizing savings for heating and cooling systems, it is hard to over-emphasize the importance of energy-efficient equipment.

When it comes to optimizing savings for heating and cooling systems, it is hard to over-emphasize the importance of energy-efficient equipment.

However, this equipment contains both a generating component and a distribution system, both of which are equally critical for maximizing energy

efficiency. If your systems are ducted, then you have an ideal opportunity for improving their performance, as duct sealing can yield significant increases in efficiency. And reduced energy loss is not the only benefit of tight ducts; a well-sealed duct system can also increase resident comfort and improve indoor air quality by preventing unintended intake of unfiltered air. A HERS rater or energy consultant can help test your system's ducts and locate any leaks or damage so that repair work can be focused in the appropriate areas.

Refrigerant Charge and Airflow Tune-up

For air conditioning systems, a refrigerant charge and airflow system check should occur as part of the annual system check-up. This type of tune-up needs to be conducted by a licensed heating and cooling contractor to determine if the system is performing to manufacturer specifications.

Clean Heat Transfer Surfaces

Coils and heat exchangers need regular cleaning to avoid build-up and ensure efficient heat exchange. To clean them, be sure to start by turning off the unit. Use cold water and either a detergent or a green cleaning agent designed specifically for use on coils. Be aware that the use of hot water can increase the pressure inside the tubing and damage the coils, so this should be avoided during the cleaning process. And remember to always check the equipment manual first, as cleaning instructions may vary.

4.4 RESOURCES

The resources listed below will assist you in developing the best plans and protocols regarding operations and maintenance for your property.

Green Operations and Maintenance Manual for the Plaza Apartments: Best Practices for a Healthy and High-Performance Building

This manual was commissioned by Enterprise for the Plaza apartment complex and was written by M. Landman Communications and Consulting. It is an example of a set of green guidelines that you could modify for use in the operation and maintenance of your own property.

→ www.practitionerresources.org/cache/documents/639/63985.pdf

HVAC Maintenance Tips from Heating and Cooling Help

This site is a great place to learn the basics of maintaining healthy HVAC systems.

→ heatingcoolinghelp.com/maintenance-tips.asp

Sustainable O&M Practice

In this article, Catherine Coombs Bobenhausen describes the components that are integral to a sustainable operations and maintenance plan. She also explains how key team members can support such practices from the start, through thoughtful choices in the design and construction of the building.

→ www.wbdg.org/resources/sustainableom.php

Water Heater Rescue

This website thoroughly addresses the problems and maintenance issues associated with water heaters. It is sure to help maintenance staff avoid equipment failure and maximize efficiency.

→ www.waterheaterrescue.com/

Additional Resources

Reliability-Centered Maintenance: Alan Pride

This article details a proactive maintenance technique called Reliability-Centered Maintenance.

→ www.wbdg.org/resources/rcm.php

4.5 LANDSCAPE AND SITE MAINTENANCE

Outdoor landscape and site management are two important components of green operations and maintenance. Landscaping benefits the property owner as well as the community by increasing the value of the property while offering natural outdoor spaces for residents to enjoy. However, some

landscaping requires large amounts of water and energy, and will generate a significant amount of plant waste. You can reduce the impact of these factors by developing a landscape and site maintenance plan with sustainability in mind. Landscaping that works with, instead of against, your site's characteristics and the surrounding environment may even help to increase your building's thermal retention (heating and cooling), and if you choose to plant native species, you will be supporting your community's economy by buying locally.

Green landscaping processes typically involve Xeriscaping, which is defined as "Climate-tuned landscaping that minimizes outdoor water use while maintaining soil integrity and building aesthetics. Xeriscaping typically includes emphasis on native plantings, mulching and no or limited drip/subsurface irrigation."¹ The maintenance requirements of a Xeriscape are generally lower than those of a conventional landscape. This is due to a reduction in turf area and the exclusion of non-native plants that might have more disease, insect control, watering and fertilizer needs because they are not as well adapted to the site as most indigenous growth.

The following sections offer highlights of the major aspects of landscape planning and maintenance from an ecologically focused perspective.

4.6 PLANT CHOICE AND LANDSCAPE DESIGN

When replanting, it is often possible to save time, money and effort in future years by choosing to incorporate native species. When the plants' natural characteristics are a good fit for your site's conditions and the region's annual rainfall, chances

are they will thrive even without a lot of extra watering or disease intervention on your part.

In addition, mulching wherever possible will not only improve the appearance of your landscape, but also simplify operations and conserve water by requiring less irrigation, enhancing plant growth and suppressing weed growth.² Wherever you choose not to mulch, try to avoid using concrete, asphalt or brick, three common impervious surfaces that are known to generate excess runoff water that is increasingly contributing to water pollution in populated areas. Instead, consider installing permeable substitutes such as rocks, sand or drought resistant plants for walkways, gathering spaces and common areas. These surfaces are better able to control the flow of storm water and retain less heat than traditional surfaces.³

4.7 PLANT DISPOSAL AND COMPOSTING

Landscape maintenance produces plant waste throughout the annual growth cycle. You can choose to compost this waste either on- or off-site simply by keeping it separate from other site waste and either allocating a space where it can break down naturally over time, or sending it away to be processed.

Composting on-site allows the organic nutrients to enrich the soil on-site, reducing the environmental impact associated with transporting the waste off-site, in addition to reducing disposal costs.⁴ For more information on composting visit the Austin Energy Green Building's™ Sourcebook.⁵

² "Mulch Basics" available at www.stopwaste.org/home/index.asp?page=147

³ "Minimize Impervious Surfaces" available at www.stopwaste.org/docs/protectwaterandair.pdf

⁴ "All About Composting" available at www.stopwaste.org/home/index.asp?page=441

⁵ "Austin Energy Green Building's Sourcebook" available at www.austinenergy.com/energy%20efficiency/programs/Green%20Building/Sourcebook/index.htm

¹ "BuildingScience.com Information" available at www.buildingscience.com/glossary/xeriscaping

4.8 SOIL PROCUREMENT

The benefits of buying local apply not only to your landscaping plants, but also to the soil they grow in. When you purchase compost, choose a variety that is produced from feedstock which includes at least 50 percent (by volume) regionally generated plant debris and/or food scraps, and specifies that the compost has less than .5 percent physical contaminants (by volume). Remember, regional procurement supports local programs.

4.9 INTEGRATED PEST MANAGEMENT (IPM) AND FERTILIZATION

Preventing pests is a critical step in eliminating the need for pesticides which can be toxic to the environment. There are many physical and biological methods for controlling pest problems, and these have been collected into an approach called Integrated Pest Management, which emphasizes the “use of physical barriers, biological controls and other forms of pest control to minimize the use of pesticides.”¹

There are insects and other pests that actually serve a natural purpose in some plant lifecycles, and can become an integral part of the landscape. Left uncontrolled, they may exist on-site without producing a hazard to vegetation or people, unless they cause an unacceptable level of damage to your landscape plantings. In this case, instead of applying pesticides, you can introduce the use of beneficial organisms – insects, arachnids, bacteria, fungi, etc., that prey on or otherwise interfere with garden pests but are harmless to plants and humans.

If your pest issues persist after IPM interventions have been attempted, it is always helpful to

minimize the amount of toxic pesticide you apply to get your pest problems under control.² You will find more detailed information on this subject in [Section 4.14 \(p. 46\): Green Cleaning and Pest Control](#).

Similarly, fertilizer use can be kept to a minimum in many cases. Many native plants do not need fertilizer, as they are well adapted to the natural conditions of the soil on your property. When choosing fertilizers for non-native plants, avoid quick-release varieties that constantly push nutrients on plants in order to stimulate growth. By contrast, slow-release fertilizers make nutrients available to the plants when needed, thus increasing the efficiency of the fertilizer which, in turn, results in cost savings.³

Overall, in keeping with the major tenet of green landscape management, minimize the use of chemical pesticides, herbicides and chemical fertilizers whenever possible, as this will reduce groundwater pollution and increase plant resistance to disease.

4.10 IRRIGATION AND FILTRATION

Your choice of plants and their arrangement on your site are significant factors in the amount of water you will need to maintain healthy and attractive landscaping year-round. Keeping your irrigation needs to a minimum helps limit water costs and reduces demand on local water resources. Ask your local landscaping providers to identify your region’s Xeriscape plants when you are shopping for new landscaping varieties.

¹ “Pennsylvania Green Building Operations and Maintenance Manual” download available at http://www.dgs.state.pa.us/portal/server.pt/community/energy/1300/green_building_maintenance_manual/254756

² “Integrated Pest Management” available at <http://stopwaste.org/home/index.asp?page=995#nurture> (p. 36-39)

³ “Nurture the Soil” available at www.stopwaste.org/docs/14521819102005nurturesoil.pdf

If sections of your landscaping do need irrigation, high-efficiency water systems are available to enable you to limit the amount of water lost to evaporation and runoff. These systems provide you with the capability to control water flow, minimizing disease and unnecessary weed growth, and offer the added benefit of reducing your water bills through more efficient outdoor water use.

In the absence of this type of irrigation system, you can still regulate your landscape water usage by installing a timer to avoid overwatering.¹ You can also train maintenance staff on how to prevent watering during or soon after rainfall, and how and when to reprogram the system to accommodate seasonal watering needs.

Another important step is to install rain or storm water filtration to ensure that water draining from your irrigation system (as well as your site in general) will be absorbed and filtered into the ground, rather than become run-off. Check the filtration system periodically to make sure it is working and is not clogged by debris.²

4.11 MAINTENANCE: MOWING AND TRIMMING

Green landscaping can require less maintenance, especially if you use native plants and mulch to limit the amount of grass lawn space on your

property. Where grass lawn is present, the following practices are suggested:

- Check with your local county agricultural board regarding the best type of grass for your climate and soil pH.
- Mow the grass when it is about 1/3 higher than the desired height. Avoid mowing lawns too short, as grass which is cut too short can require more water due to stress and over-drying.
- Leave the clippings where they fall, as this will provide extra nutrients for the soil to absorb. If clippings must be removed, then compost them.
- Water the lawn before sunrise or after dark to cut down on evaporation.³

COMPARE POLLUTION EMISSIONS		
	Gasoline mowers Grams/year	Electric mowers Grams/year
Hydrocarbons	1475.0	0.8172
Carbon Monoxide	11425.0	4.572
Carbon Dioxide	24075.0	21240.0
Nitrogen Oxides	50.0	11.28

Figure 2: Pollution Emissions of Lawn Mowers (Source: Greenseal)

Choose your mowing equipment wisely. The cumulative effects of electric and gas mowing equipment can make a significant environmental impact, especially in densely populated areas. Gas-powered lawn equipment makes a notable contribution to the deterioration of air quality and ultimately, human health. Electric equipment emits between 5 and 9,000 times less pollution than gas powered mowers, depending on the specific emission (see Figure 2). Though the initial cost of an electric mower is higher than that of a

¹ “Xeriscape” available at xeriscape.sustainablesources.com/ (5.0 Efficient Irrigation)

² “Pennsylvania Green Building Operations and Maintenance Manual” download available at www.dgs.state.pa.us/portal/server.pt/community/energy/1300/green_building_maintenance_manual/254756

³ “Lawn Care Equipment” available at www.greenseal.org/resources/reports/CGR=LawnCareEquip.pdf

gas mower, GreenSeal argues that over a period of 10 years, the cost of an electric mower comes to half that of a gas mower.

GreenSeal recommends:

- Choosing electrical equipment with:
- Adjustable grass height settings
- Mulching options
- Batteries (for small areas)
- Choosing gas equipment with:
- A 4-cycle engine
- Overhead valves
- A performance level that meets standards such as those of the California Air Resources Board
- Adjustable grass height settings
- Mulching options

4.12 OUTDOOR LIGHTING

In the U.S. today, two-thirds of the population cannot see the Milky Way in the night sky, and 40 percent never experience enough darkness at night to require full night vision.¹ These conditions are exacerbated by light pollution, night lighting that interferes with surrounding ecosystems and prevents viewing of the stars and night sky by inhabitants of urban areas.

Areas of higher residential density are naturally prone to light pollution, but there are steps you can take to minimize it. First, ensure that outdoor light fixtures are pointed in the right direction and are not over-lighting areas beyond what is necessary for security purposes. Light that is too bright can

result in glare and shadows, compromising the comfort of surrounding residents and in some cases, compromising security. When replacing fixtures, choose full cut-off or down lit fixtures, which are designed to prevent light from being projected above the horizontal plane and instead, focused in the downward direction that requires lighting.² If possible, place outdoor lighting on timers and motion sensors to ensure it does not stay on during daylight hours and goes off when not needed. Remember to adjust sensors seasonally, as daylight cycles vary significantly during the course of a year.

4.13 RESOURCES

The following resources below offer information on sustainable landscaping, as well as other green measures that can be implemented onsite.

Pennsylvania Green Building Operations and Maintenance Guidebook

This guidebook provides information on green maintenance, including chapters on site maintenance such as landscaping and outdoor lighting.

→ http://www.revenue.state.pa.us/portal/server.pt/gateway/PTARGS_0_2_10941_1300_254756_43/http%3B/pubcontent.state.pa.us/publishedcontent/publish/cop_general_government_operations/dgs/community_content/property_management/subcommunities/facilities_management/document_management/green_building_manual/greenbuildingbook.pdf

A Sourcebook for Green and Sustainable Building

The Sourcebook, by Sustainable Sources, offers both design and maintenance information on green approaches to managing water, energy, materials, and solid waste.

¹ "Light Pollution" available at www.aae.org.uk/Life_in_the_Universe/light_pollution.htm

² "Pennsylvania Green Building Operations and Maintenance Manual" download available at http://www.dgs.state.pa.us/portal/server.pt/community/energy/1300/green_building_maintenance_manual/254756

For more information on Xeriscaping:

→ xeriscape.sustainablesources.com

For more information on composting:

→ www.greenbuilder.com/sourcebook/CompostSystem.html

Additional Resources

A Guide to Green Maintenance and Operations: StopWaste.Org, Alameda County Waste Management Authority

This guide identifies the factors you will want to take into consideration when selecting environmentally preferable products for use during building maintenance. Practical, effective operation and maintenance strategies for energy efficiency, natural resource conservation and indoor air quality protection are integrated throughout.

→ www.stopwaste.org/docs/gbmg-dec-20-07ltr.pdf

4.14 GREEN CLEANING AND PEST CONTROL

There are many benefits to be realized from incorporating green cleaning and pest control policies across your organization's portfolio. When you bring green practices to bear in these areas, your efforts can contribute to the improved health of not only your residents, but also your staff. The impact is especially significant to those individuals who are particularly susceptible to environmental hazards, including young children, seniors and those with certain types of illnesses such as asthma and emphysema. But the positive effects don't necessarily stop at your property's boundary line. By choosing cleaning and pest control products that are made without the use of harmful chemicals, you are helping to decrease the amount of pollutants that end up in our soils and waterways.

4.15 CLEANING AGENTS

Green cleaning refers to the purchase and use of cleaning products that are not harmful to human health or the environment. It also includes the establishment of a regular cleaning and maintenance schedule to promote consistent upkeep of a property, which can help lengthen the lifespan of equipment and buildings overall.

Is the person in your organization responsible for purchasing aware of which brands fulfill the specific requirements set out for environmentally safe products? Discerning whether or not products meet these requirements can be more difficult than it sounds, because loose and misleading advertising abounds in today's marketplace. Descriptors such as "all-natural," "environmentally safe," and "green" are used regularly by manufacturers without the support of scientifically proven data to back up their claims. In order to make a truly informed product choice, you will need to look for products that have been approved through an independent, third-party organization. Such organizations test green cleaning products, identify those that are measurably safer and healthier when compared to conventional products, and approve or certify them so consumers can recognize them as authentically beneficial. You can find more details on these organizations, along with some links, in this section's tools and resources. Also, if your organization's budget allows, consider providing a basket of green cleaning supplies for residents or hosting a green cleaning learning event.

4.16 PEST CONTROL

Integrated Pest Management (IPM) is an environmentally friendly approach to pest control that focuses on prevention. IPM uses non-chemical solutions to pest problems involving an ongoing cycle of inspecting, altering pest-friendly conditions, monitoring pest presence, and documenting pest and pest control activity. Vacuums are commonly used for pest removal and chemical treatments are applied only as a last resort.

Green Pest Management (GPM) takes IPM to the next level by excluding the use of synthetic pesticides. Instead, GPM uses naturally occurring and low-risk materials, such as botanical oils and biopesticides, when these are needed to resolve infestation problems.

There are six basic steps involved in the operation of an IPM or GPM program:

- Diagnose and monitor pest problems.
- Prevent pests from getting into the building through cracks in the building envelope.
- Remove inappropriately stored food, water and other items that attract pests.
- Treat identified problems only, rather than blanket treating entire buildings.
- Keep precise records of pest control activities and treatment.
- Evaluate and improve the program.

Though implementation of an IPM or GPM program may require additional labor from management staff, the costs involved are still far less than those of professional chemical treatments. The high cost of resident displacement for building tenting or the spraying of toxic materials are also avoided with the use of an IPM or GPM program.

4.17 TOOLS

The tools in this section are helpful guides for directing both management teams and residents to sustainable cleaning and pest control practices.

EPA's Green Cleaning Pollution Prevention Calculator

This calculator quantifies the projected environmental benefits of purchasing and using green janitorial services and products, showing the specific environmental benefits you can achieve by reducing chemical use in your typical cleaning routine. It also can help identify which of the green cleaning options available to you will have the greatest impact on reducing cleaning-engendered hazardous chemicals and pollution at your site. Though the tool is designed for green cleaning in office buildings, it is included here because many of the practices are similar to those used in affordable housing maintenance.

→ <http://204.12.33.69/janitor/index.asp>

Multifamily Property Resident Education Tip Sheets for Pest Control

Orkin put together these handy tip sheets which can be distributed to residents for pest prevention education.

→ www.orkincommercial.com/docs/Orkin_TipSheets_Tip%20Sheets_FINAL_12.4.08.pdf

Additional Tools

Green Shield Certified Program Guide and Evaluation Form for Facilities

This document explains the principles and criteria of the Green Shields pest management program and offers a form for evaluating your practices.

→ www.greenshieldcertified.org/standards/facilities.pdf

4.18 RESOURCES***Integrated Pest Management: A Guide for Managers and Owners of Affordable Housing***

This guide, written by the Boston Public Health Commission, describes a process of pest control found to be effective in public housing developments around the country.

→ www.healthyhomestraining.org/ipm/IPM_MFH_Hand_1_ARC_IPM_Toolkit_9-11-08.pdf

A corresponding course, entitled “Integrated Pest Management in Multifamily Housing,” was developed to train managers in implementing an IPM program.

→ www.healthyhomestraining.org/ipm/training.htm

Related Healthy Homes Resources

This site compares traditional pest control with the less toxic Integrated Pest Management approach, using cost and effectiveness as concrete measures.

→ www.healthyhomestraining.org/ipm/Case_Study_Costs_10-26-07.pdf

You can find information about how to find an IPM contractor here:

→ www.healthyhomestraining.org/IPM/Vendor.htm

Information on how to write a Request for Proposal for IPM services, as well as a model for writing an IPM services contract, can be found here:

→ www.healthyhomestraining.org/IPM/contract.htm

GREENGUARD Environmental Institute

The GREENGUARD Environmental Institute product guide offers a user-friendly product search of all GREENGUARD indoor air quality certified

products, including cleaning products, finishes and materials. Using these products instead of traditional ones can help to improve and protect indoor air quality at your site.

→ www.greenguard.org

EcoLogo

The EcoLogo program provides third-party certification of a large variety of everyday products, from furniture to adhesives. The EcoLogo website hosts an online product search that even allows you to look up cleaning agents by their intended use.

→ www.ecologo.org

Additional Resources**Critter Library: Havahart**

This site provides information about various pests and how to control them humanely.

→ www.havahart.com/advice/critter-library

Green and Clean: The Designer’s Impact on Housekeeping and Maintenance: Stephen Ashkin

This article was published in *Environmental and Economic Balance: The 21st Century Outlook*, and offers interior design ideas that improve the “cleanability and maintainability” factors of a building.

→ www.ashkingroup.com/pdfs/Architect/AIAPAPER.PDF

A 10-Step Guide to Green Cleaning Implementation: H2E

You will find the basic process for making the switch to green practices outlined in this article, published by Hospitals for a Healthy Environment (H2E).

→ www.h2e-online.org/docs/h2e10stepgreenclean-r5.pdf

4.19 RESIDENT BEHAVIOR

It's not buildings that use energy, it's people. While building owners and managers exercise control over the level of energy efficiency that is built into infrastructure, equipment and maintenance, residents control many day-to-day decisions about conserving energy and water.

4.20 ENERGY CONSERVATION

In many cases residents are motivated to save energy, as it can be directly translated into reductions in their utility bills. Equipping residents with expanded and up-to-date knowledge on energy conservation will help them achieve their own energy reduction and cost savings goals. As part of this process, they will need information about and practice with operating their unit's controls for space conditioning and lighting. In addition to reducing energy use, this may also prolong the life of the mechanical equipment involved, since resident training increases the likelihood that it will be used properly.

Recommendations for resident training include:

- Give residents a live demonstration of how to program their thermostat, or have building management help new residents to program their thermostat upon occupancy; provide an easy-to-read cheat sheet that residents can reference when they need to change the programming.
- Distribute a tip sheet to residents on ways they can conserve energy; offer ongoing resident education by posting information around the building.

It's not buildings that use energy,
it's people.

4.21 WATER CONSERVATION

Motivating residents to save water can be challenging, especially if the water is master metered and the cost is borne by the building owner. Still, many people respond positively to conservation programs that highlight choices and changes that cost them little or nothing to implement. Alert residents to water and environmental issues that affect your specific area, and offer tips for water conservation to encourage new behaviors that will result in reduced use.

A study by the American Water Works Association Research Foundation

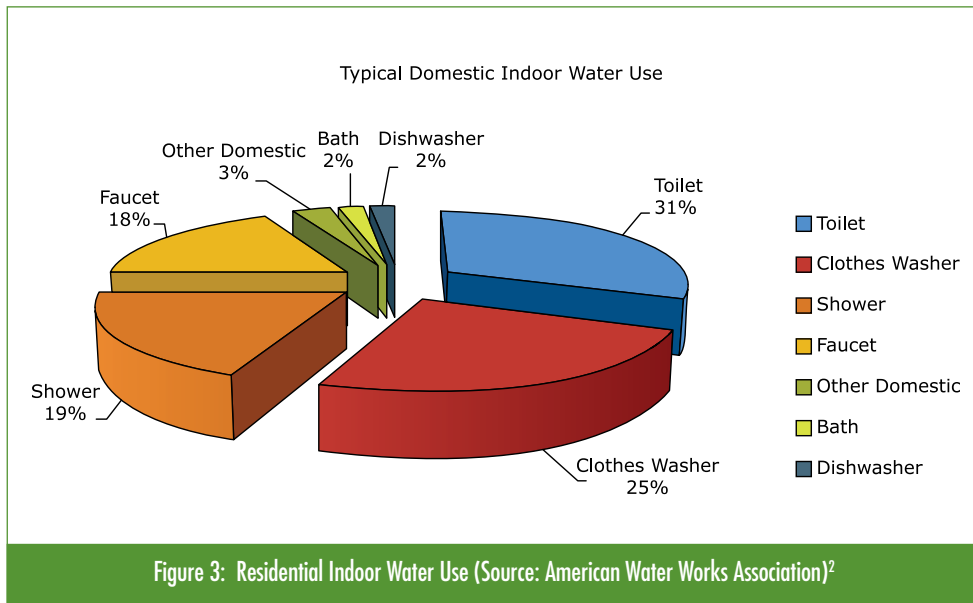
showed that nearly a third of household indoor water is used by toilets. Providing dual flush toilets requires the residents to make conscious decisions each time they flush.

The same study demonstrated that the next highest residential water usage is for washing clothes. One way to bring about greater awareness of water saving measures is to post educational posters outlining steps residents can take when doing laundry. Displayed in target areas such as shared laundry rooms or next to in-unit laundry appliances, these can serve to remind and encourage residents to wash full loads, use a cold-water wash cycle and consider air drying their clothes. If using a clothes dryer, remind residents to clean the lint filter before each load. These tips will save water and energy, as well as prolong the useful life of many clothing materials.

Information about how much water can be saved (on average, 390 gallons a month¹) from cutting shower times by just 5 minutes a day and turning off the faucet while brushing teeth are just two of a wealth of quick tips that could be included in a tip sheet provided to residents at move-in.

prone to illness or experiencing a chronic lack of wellness work less. This, in turn, can affect their financial stability, as well as their families and their social lives. It can also become a problem for building owners and managers, as employers.

Fortunately, there are options. Using green cleaning



products can reduce the toxic vapors within a whole building, as well as within individual units. It also cuts down on the amount of toxic waste contaminating local landfills and ultimately, the surrounding habitats. Providing cleaning kits equipped with

4.22 CLEANING AGENTS

A growing body of research points to the fact that common household chemicals can be hazardous to our health. Both employees and residents are exposed to cleaning agents and other substances used on a regular basis to keep buildings tidy and well-maintained. Along with medical consequences, adverse reactions to long-term exposure to such chemicals can impact many areas of an individual's life. For example, healthy employees and residents take fewer unplanned days off work, while those

green household cleaners to new residents at move-in is a distinctive and effective means of focusing attention on the issue, encouraging a neat and clean approach to home maintenance, and identifying the healthy alternative products commonly available at the local grocery store.

4.23 RECYCLING

Nationwide, apartment-building units recycle about 10 percent less waste than single-family residences, according to a 2001 study issued by the U.S. Environmental Protection Agency.³ You can help change this by encouraging residents to recycle more of their waste more often and supporting

¹ "Water Saving Tips" available at www.bewaterwise.com/tips01.html

² "Residential End Uses of Water" Summary available at www.waterresearchfoundation.org/research/topicsandprojects/execSum/241.aspx

³ "California Considers New Recycling Law" available at www.scrippsnews.com/node/25245

resident-led recycling programs. Provide each unit with a container for collecting recyclables, and install recycling bins at all community garbage collection areas. You may find it necessary to clearly mark trash and recycling containers, listing the items and materials that are appropriate for each container to avoid confusion and the mixing of trash and recyclables.

4.24 NO SMOKING POLICY

Allowing residents to smoke inside their apartments or while using community facilities will not only negatively affect the health and comfort of neighbors (both smoking and nonsmoking), but can also increase maintenance costs and fire risks. In fact, nationwide statistics revealed that smoking was the leading cause of fire deaths in multifamily buildings in 2005¹, and is the cause of up to 40 percent of all apartment building fire deaths each year. Because of this, and because of the pervasive and serious effects of secondhand smoke, HUD has issued a statement strongly encouraging all public housing authorities to ban smoking at their sites.

As a proven health threat, secondhand smoke needs to be controlled at any multifamily residential property. Expert opinion has identified the only effective means of eliminating the medical risks associated with secondhand smoke is to

ban smoking in the building.² Additionally, the apartments of smokers need more attention at turnover. After a smoking resident moves out, new flooring, paint and appliances as well as additional cleaning can result in turnover costs up to six times higher than those of a nonsmoker's unit. On the other hand, managers of smoke-free buildings can save money by seeking insurance coverage from one of the providers who offer a discount on properties where smoking is prohibited.

After a smoking resident moves out, new flooring, paint, and appliances as well as additional cleaning can result in turnover costs up to 6 times higher than those of a nonsmoker's unit

Remember, there is no law protecting the right to smoke. Landlords are free to implement no smoking policies in buildings and on properties, and a growing number of health-conscious residents are seeking

out – and even expecting – indoor environments that are smoke free.

4.25 TOOLS

Enterprise Green Communities' Carbon Calculator

This user-friendly online calculator can help residents discover their carbon emissions.

→ www.greencommunitiesonline.org/tools/carbon-calculator/calc.asp?page=individual

Additional Tools

Room-by-Room Energy Savings Tips: Environmental Protection Agency, ENERGY STAR®

This interactive tool takes you room-by-room through a home to suggest energy savings tips for every area

¹ "Action on Smoking and Health Press Release" available at ash.org/ashprhud

² "Environmental Tobacco Smoke" available at www.ashrae.org/content/ASHRAE/ASHRAE/ArticleAltFormat/20058211239_347.pdf

of life. Some of these tips apply directly to residents, but many will prove helpful to management in the selection of building improvement measures.

→ www.energystar.gov/index.cfm?fuseaction=popuptool.atHome

You can also read about a number of ENERGY STAR®'S household tips for saving energy, organized by room, at the link below.

→ www.energystar.gov/index.cfm?c=products.es_at_home_tips

4.26 RESOURCES

Flex Your Power

Flex Your Power is California's statewide energy efficiency outreach campaign. It is a great resource for energy conservation tips and recycling ideas you can pass on to residents.

→ www.fypower.org/res/tools/energy_tips.html

Recycling Guidelines for Multifamily Housing Design

These guidelines, published by Stopwaste.org, offer ideas concerning design choices that can help make multifamily buildings more recycling-friendly.

→ www.stopwaste.org/docs/1720381662005mfu-designguidelines.pdf

Don't let the humble scope of 'easy fix' measures fool you – over time, the returns in terms of financial savings and conservation of resources can be considerable.

Trolley Square Living Green Manual

Homeowners Rehab, Inc. wrote this manual to provide English- and Spanish-speaking residents at Trolley Square with green living guidance, in both site-specific and general terms. Use this as a template or a model for developing resident guidelines for your properties.

Trolley Square Green Living Guide

→ www.greencommunitiesonline.org/tools/resources/

Trolley Square Manual Para Vivir Verde

→ www.greencommunitiesonline.org/tools/resources/

Smoke Free Housing

This site provides landlords with resources and tips for implementing no smoking policies.

→ www.smokefreeforme.org/landlord.php

Additional Resources

Reasons to Explore Smoke-Free Housing: co-hosted by Enterprise's Green Communities program and the National Center for Healthy Housing

This web-based training session brought together national experts and practitioners for a dialogue around implementing smoke-free policies for multi-unit buildings.

→ www.practitionerresources.org/showdoc.html?id=67279&topic=7.%20Healthy%20Living%20Environment&doctype=Spreadsheet

Recycling: Earth 911

This website provides a tool for finding the recycling locations nearest to you.

→ earth911.com/recycling/

100+ Tips for Reducing Water Use: *Water Use it Wisely*

This website highlights over 100 ways to reduce water consumption.

→ www.wateruseitwisely.com/100-ways-to-conserve/index.php

4.27 UNIT TURNOVER PROTOCOLS

The access gained during unit turnover provides an excellent opportunity for implementing green upgrades and maintenance without disturbing residents. Transitioning to green asset management is a process, and somewhere along the line most properties undergo a retrofit or rehabilitation at the building level. Turnover, however, opens the door to green upgrades at the dwelling unit level. Planning is key, so the first step is for the green asset management team to identify all the upgrades that could potentially be made at the apartment level, and then evaluate each one for cost effectiveness.

Some of the most obvious improvements are energy and water efficiency upgrades, but these are not the only choices open to the team. Transforming a turnover checklist into a *green* turnover checklist is a first step, and will go a long way toward improving operations and maintenance on your property. There are several areas of focus at turnover; many have already been covered, but we will briefly revisit them here from a turnover perspective, along with a few new suggested changes.

Materials

When painting or replacing carpet or other flooring, choose low- or no-VOC products.

The same applies when replacing cabinets and countertops. Low- and no-VOC products have both health and comfort benefits, reducing the volatile organic compounds released into the air from new products and upgrades, while also reducing uncomfortable smells.

Choosing materials that can be recycled will also reduce any impact on the environment, and you may be able to cut down on disposal costs if old materials are diverted from your local landfill upon removal.

Cleaning and Pest Control

A temporarily unoccupied unit offers a great opportunity to implement the low-impact cleaning and pest control protocols discussed in [Section 4.14 \(p. 46\): Green Cleaning and Pest Control](#). There is also no better time than when

Transforming a unit turnover checklist into a green unit turnover checklist is relatively simple.

an apartment is empty to vacuum and seal cavities that may harbor unwanted pests. Cleaning and ventilating an

apartment thoroughly at turnover can also prevent future health issues and prolong the life of building and finish materials.

Prescriptive Replacement

Managers typically use turnover to assess appliances and mechanical systems and their components to see what might need replacing. In choosing your replacements, make it a point to select energy and water efficient products. When you consider lifecycle costs – not just upfront costs – in your evaluation, you will find that many of the items that use the least amount of energy or water are also the most cost efficient.

[Visit Section 3.10 \(p. 25\): *Methods of Cost Analysis*](#) for assistance with accurately calculating the cost of green upgrades. For more information on replacement decisions, see [Section 5.1 \(p. 58\): *Selecting Upgrade Measures*](#).

System Maintenance

With an empty apartment, system maintenance is never invasive. Check the maintenance schedule for the unit's equipment and to see if any work due in the near future could perhaps be completed early while there is no resident in the unit, thereby avoiding the risk of having maintenance delayed once occupants are in place. [Section 4.1 \(p. 38\): *Mechanical Systems and Equipment*](#) provides more detailed information on system maintenance.

4.28 MONITORING

As part of supervising operations and maintenance on your property, one of the best ways to maximize on-site efficiency is to monitor costs and performance over time. This involves tracking utility costs and performance for both energy and water to identify the strengths and weaknesses of your management strategies. Monitoring helps your management team recognize interventions and practices that work well and are worthy of replication across your portfolio. It also allows you to pinpoint poorly performing buildings, investigate and remedy anomalies and make informed improvement decisions concerning your operations and equipment strategy.

However, in order to produce these results, accurate data must be used for the monitoring process. It is therefore critical that your team put in place a

consistent mechanism for measuring and tracking the performance of your building(s). The task of developing and implementing such a system can be challenging, particularly in determining which performance metrics are most important, at what phase in the building's lifecycle these need to be captured, and how to use the data to inform future decisions. Fortunately, there are several management tools available to simplify and streamline the process. "Portfolio Manager," the Environmental Protection Agency's (EPA) benchmarking program, is just one example of a system comprehensive enough to meet the needs of most asset management teams (further details are outlined in the following section). Alternatively, you can develop your own monitoring tool tailored to meet the specific requirements of your portfolio.

Whatever tool you choose, be prepared to stick with it over the long term, as analyzing performance should be an ongoing task throughout the life of a building. The management team will be monitoring the building's energy and water consumption, and identifying the amount of resources consumed by various building operations (for example, heating, cooling, hot water heating, electricity, etc.) as months and years go by. The team will then compare these consumption levels with benchmarks to assess efficiency and the effectiveness of any improvements and other changes.

Benchmarking

Benchmarking is a monitoring tool that estimates energy and water consumption and uses comparisons with other buildings of the same type and location to

rate performance. The building's performance ratings are then tracked over time to identify improvements and deficits. It is a first step in managing energy and water costs and can help save resources and money on its own or serve as the launching point for a more comprehensive program. Benchmarking systems can stay simple, or increase in complexity to include other factors that influence energy use such as plug loads, intensity of use for a building and climate.

Benchmarking will make it possible for your asset management team to:

- Track and assess energy and water consumption across an entire portfolio of buildings
- Track greenhouse gas emission reductions and achievements
- Identify under-performing buildings
- Set investment priorities
- Establish and target efficiency goals
- Verify efficiency improvements
- Develop an efficiency plan to achieve performance goals

As mentioned above, there are a number of systems you can use to support your benchmarking efforts. In this section of the manual, we will walk through the EPA's Portfolio Manager, using it as an example of how a benchmarking system works. Portfolio Manager is an interactive energy management tool for tracking and assessing energy and water consumption across an entire portfolio of buildings in a secure online environment.

In February 2009 the EPA added multifamily housing space as a "type" option for their Portfolio Manager tool. This feature allows you to input the

number of units, square footage, percent heated, percent cooled, market rate versus affordable housing, percent of square footage that is common space, and more. There is not yet enough data for the EPA to create a comparative benchmark, but in the future, multifamily buildings will be able to be ENERGY STAR® rated. Specifically, Portfolio Manager will eventually allow building owners to manage energy and water consumption for all buildings in a portfolio of properties, and to set capital expenditure priorities.



David & Joyce Dinkins Gardens, New York, NY

Manage Energy and Water Consumption for All Buildings

Having entered the amount of energy (electricity, gas, etc.) and water consumed within a specific building, along with the related costs, for a minimum of 12 consecutive months, you will be able to generate a weather-adjusted energy use intensity (EUI), a metric for analyzing energy performance in multifamily housing. If a building has less than 12 months of data available, that

data can still be entered and an EUI will be generated when the twelfth consecutive month is entered. The tool also allows you to manipulate the data in a variety of ways. You can identify and investigate spikes or trends in energy consumption; set goals for energy, water, or cost management and track your progress toward them; compare levels of consumption with other buildings; and track consumption against seasonal climate shifts, weather conditions, maintenance personnel changes, resident behaviors, or any other factors you decide are relevant to building performance. These analyses then provide a concrete foundation on which to base the team's strategies for saving resources and money.

Although it sounds complex, the tool actually functions to streamline your energy and water data, and can organize it both by building and portfolio-wide, depending on your needs. For example, one can:

- Track multiple energy and water meters for each facility
- Customize meter names and key information
- Benchmark facilities relative to their past performance
- View percent improvements in weather-normalized source energy
- Monitor any changes in the cost of energy and water
- Share building data with residents and others inside or outside the organization
- Enter unique operating characteristics, specific to each categorization of how space is used within a building

Data can be reviewed from within Portfolio Manager, or easily exported to Microsoft Excel for the creation of charts or graphic representation.

Set Investment Priorities

Portfolio Manager provides a platform for tracking both consumption and cost of energy and water. This provides a more complete picture of the avoided utility costs associated with increased efficiency. In other words, if energy use decreased 10 percent at a particular building, but energy rates increased 10 percent, the asset manager would see the full financial benefit of the increased energy efficiency rather than looking at energy costs as flat. Portfolio Manager also allows asset managers to compare energy performance across their portfolio using 'weather adjusted energy use intensity' (EUI). EUI is basically a measure of energy use per square foot, taking into account weather patterns that may have affected heating and cooling loads. Using this EUI metric, asset managers can identify under-performing buildings, and prioritize energy efficiency investments (starting with larger buildings that have the highest EUIs). The tool also can track energy-efficiency investments alongside savings. This provides asset managers information about which upgrades had the highest benefit-to-cost ratio, and quickest paybacks, which will support future investment decisions.

In addition, the built-in financial tool allows you to compare cost savings across buildings in your portfolio, as well as to calculate cost savings for a specific project. Being able to quickly and clearly obtain figures showing annual energy costs, or the results of cumulative investments in facility

upgrades, makes it easier to decide on which best practice management strategies are the right ones for your site and portfolio.

Verify and Track Progress of Improvement Projects

In certain instances involving contracts or real estate issues, a Statement of Energy Performance (SEP) document will be required. For example, SEPs are needed to:

- Satisfy LEED for Existing Buildings (LEED-EB) requirements
- Support mortgage, sale and/or lease transactions
- Document performance in energy service contracts
- Communicate energy performance with residents/owner/customers

Once you have established a record in your benchmarking program, you will be able to generate a SEP for each building in your portfolio as necessary. It will contain a summary of important energy information and building characteristics, such as site and source energy intensity, CO₂ emissions and gross floor area.

4.29 TOOLS

EPA's Portfolio Manager

The EPA's Portfolio Manager is one option to consider using to benchmark your buildings, as well as track energy and water use, greenhouse gas emissions and the financial performance of your portfolio, all at one online location.

→ <https://www.energystar.gov/istar/pmpam/>

For a quick overview of Portfolio Manager's features, visit:

→ www.energystar.gov/ia/business/downloads/PM_QuickRefGuide.pdf

For sample views of building information using Portfolio Manager see [Appendix D \(p.92\)](#).

Energy Tracking Card

This document is an example of an energy savings card that can be used either by residents to track energy consumption within their dwelling unit, or by management to monitor energy consumption for a whole building. Typical energy savings measures are included, in addition to space for recording actual usage.

→ www.climatewise.net.au/Documents/Energy%20tracking%20card.pdf

4.30 RESOURCES

DSIRE – Database of State Incentives for Renewables and Efficiency

DSIRE is a comprehensive source of information on state, local, utility and federal incentives that promote renewable energy and energy efficiency.

→ www.dsireusa.org/



SECTION 5 DEVELOPING A PLAN FOR BUILDING UPGRADES

5.1 SELECTING UPGRADE MEASURES

The list of upgrades described in this section of the manual is not exhaustive, but you will find it contains many of the most commonly installed retrofit measures. As your asset management team considers which options are most appealing for your specific requirements, there are several important factors to keep in mind, as discussed below.

When you view the building as a whole integrated system, you come closer to an accurate understanding of its true energy profile.

Integrated, Whole Building Design

When you view the building as a whole integrated system, you come closer to an accurate understanding of its true performance profile. The interactions between all relevant components can be assessed when a holistic perspective is maintained. This reflects the complexity, as well as the synergy, of

integrated systems which always adds up to be more than the sum of its isolated component parts.

High performance can thus be achieved through selecting a cost-effective package of measures focused on resource efficiency, durability and health. The actual benefits accrued from each measure you implement are highly dependent on how they each interact with other building elements, new and existing; in this systemic approach, no one measure by itself will guarantee high cost savings. For example, increasing attic insulation will result in decreased heating and/or cooling loads; additionally, a smaller, less expensive furnace and/or air conditioner may be able to handle the reduced loads. Installing these upgrade measures together will be more cost effective than installing the most efficient furnace and/or air conditioner on the market.

When combining various interventions, therefore, the order of their implementation becomes quite important. Some general rules for this include:

- Consider basic occupant health and safety issues first.
- Make envelope improvements before space conditioning improvements.
- Increase energy efficiency before installing renewable energy systems.

Avoid Lost Opportunities

When structural or cosmetic changes are planned as part of a building rehab, be sure to carefully consider whether opportunities might arise for improving energy and water efficiency and be prepared. Replacing the roof? Plan to insulate and add radiant barrier while this physical space is accessible. You won't find a better chance to make these upgrades anytime in the next 15 years. Similarly, replanting the grounds or conducting a complete landscape overhaul presents an ideal opportunity for improving or replacing your existing irrigation system and upgrading its efficiency with new technology.

It also pays to consider future upgrade opportunities as you plan your present ones. If your team is aware of renovations or improvements that will be budgeted and scheduled for in the not-so-distant future, make sure what you do today does not block the even greater opportunities of tomorrow. Ask yourselves, "What is the scope of our current upgrade work? What might the scope of work be the next time around?" For instance, suppose there aren't sufficient funds to purchase a high-efficiency cooling system right now but the team anticipates there will be in the not-too-distant future. Rather than going ahead with installing a new cooling system now and having to settle for a minimum-efficiency model, you could consider delaying the cooling system upgrade and making improvements to the building envelope instead. By opting for upgrades such as installing radiant barrier and insulation, you can reduce the cooling load, achieve cost-effective savings, increase

resident comfort, and reserve the opportunity for installing a high-efficiency air conditioning system for when your budget permits such an investment.

5.2 ENVELOPE

Building professionals call the outer layer of a building "the envelope" because it envelops the interior living space. The envelope refers to a wide variety of elements including walls, roofs, floors, windows and doors, all made with different materials but sharing one thing in common: they are the factors responsible for placing the greatest loads on energy consumption when it comes to heating and cooling. That is why so much focus is placed on ensuring these components are as energy efficient as possible. If you plan carefully, not only will you be able to avoid wasting energy, you can actually use well-designed envelope components to save energy through reflecting or retaining heat, as appropriate for the season.

Air Sealing – Reducing Infiltration

Infiltration is the unintentional exchange of conditioned air with unconditioned air through cracks and leaks in the building envelope. Loss of conditioned air and the subsequent need to condition newly infiltrated air requires a significant expenditure of energy. In fact, air infiltration can account for up to 30 percent or more of the energy dedicated to heating or cooling a building.¹ When you seal cracks, joints and other leakage sources, you prevent this waste of energy and at the same time minimize moisture infiltration, make living spaces draft and mold free, and greatly improve

¹ "Air Barriers" available at www.energysavers.gov/your_home/insulation_airsealing/index.cfm/mytopic=11300

resident comfort. Sealing can be accomplished simply and inexpensively by adding weatherstripping to doors and windows, patching holes and caulking joints in the building envelope.

Insulation

Each part of the building envelope has its own unique properties concerning the transfer of heat. Heat flows through a building from warm places to cool places whenever there is a temperature differential between zones, such as between a kitchen and a connected garage, for example. In doing so, heat passes through both the solid materials that make up a building, and the air that fills any empty space within. The greater the temperature difference, the greater the heat flow from a hotter zone to a colder one.

Insulation resists this heat flow. Thus, insulating any barrier between conditioned and unconditioned space will increase the energy efficiency of a building or home. Important things to know when planning to add insulation are:

- Increasing attic insulation is a viable option for most existing multifamily buildings, and is most cost effective in low-rise building types.
- Increasing wall insulation is best achieved in rehab projects that include the removal of drywall down to the studs, but it can be achieved under alternative circumstances. Insulation can be blown in through a hole drilled in each stud bay for filling wall cavities.
- Raised floors and exposed slabs can also benefit from the addition of insulation.

The energy performance specification, or R-value, of an insulation substance is the measure of that material's resistance to heat transfer. Recommended R-values vary by climate conditions, and the U.S.

Department of Energy has created an [insulation calculator](#) to suggest an appropriate insulation level for each area of the country.

Insulation is most effectively installed when it is placed so that it is in physical contact with the material that creates a physical barrier to air movement in that location – dry wall or sheathing, for example. It is also important to avoid any voids, gaps, or compressions. If you want to check how well your insulation has been fitted to your building, a HERS rater can conduct a Quality Insulation Installation inspection and provide you with feedback.

Radiant Barriers

In multifamily buildings, the summer sun can heat an attic to temperatures as high as 140° F. This heat radiates down into dwelling units, increasing their temperature as well, and causing air conditioning systems to work much harder and use more energy. A simple and cost-effective solution for keeping the sun's heat from penetrating the roof and heating up the attic is a radiant barrier. A radiant barrier can reduce attic temperatures by as much as 30° F and block up to 97 percent of radiant heat gain, saving energy and increasing comfort.¹ Additional energy savings are possible in buildings that have their HVAC and ductwork located within the attic space, because radiant barriers effectively reduce heat gain in this equipment as well.

¹ "Radiant Barriers" available at www.toolbase.org/Technology-Inventory/Roofs/radiant-barriers

Radiant barriers are typically made up of a reflective layer of aluminum foil or plastic film. The essential characteristic of radiant barriers is their high reflectance and low emittance.¹ Reflectance indicates how much radiant heat is reflected by a material, while emittance refers to how much radiant heat it gives off, or emits, at a certain temperature. Opaque materials with high reflectance will have low emittance. Radiant barriers are designed with reflective surfaces on either one or two sides. If a one-sided radiant barrier is installed in a building, the reflective side must face an air space to be effective.

Radiant barriers reflect the radiant heat from the sun and so are most effective in hotter climate zones and in low-rise buildings. Two-sided radiant barriers can also provide some energy savings during the winter when cold weather means heat energy inside a building is radiated out towards the cold exterior. In this case, the second side of the radiant barrier reflects heat back towards the interior of the building, so that very little radiates to the outside.

Windows

Historically, windows have been the weak link in a building's thermal envelope. Single pane windows, which are commonly found in multifamily apartment buildings built more than 25 years ago, have about the same insulating value as a sheet of metal. The introduction of dual glazing was a great improvement that nearly doubled the insulating value of the window.

¹ For opaque materials, the sum of reflectivity and emissivity factors is 1.

Some of the factors that affect window performance are:

- Type of material used for frame and sash
- Size of space between glazing layers
- Type of gas between glazing layers
- Type of spacer between glazing layers
- Type of coating(s) on glazing layers

The National Fenestration Rating Council has developed a window evaluation system based on three basic window properties:

- Insulation value (U-factor) – the measure of heat transfer from difference in air temperature
- Solar radiation control (Solar Heat Gain Co-efficient or SHGC) – the measure of heat transfer by solar radiation
- Visibility (Visible Transmittance or VT)

The U-factor and SHGC required for optimal window efficiency vary depending on whether the building is in a heating or a cooling climate. Each climate zone has its own characteristic mix of heating and cooling days throughout a yearly seasonal cycle, and the best option will vary accordingly.

In climates where the predominant need is for cooling indoor spaces, customized window design can pay off when paired with other high-efficiency envelope components, yielding enough of a reduction in the cooling loads on the building to allow downsizing of the air conditioning equipment. The savings in air conditioning equipment costs can help cover the extra costs involved in installing high performance windows and other customized envelope components.

5.3 HEATING, VENTILATING AND AIR CONDITIONING (HVAC) EQUIPMENT

Improving a building's energy efficiency by installing high-efficiency heating or cooling equipment and distribution systems does not have to involve a prohibitively high initial investment. By combining your equipment upgrade with new measures to boost the efficiency of your building envelope, and then accurately calculating the building load so that your new equipment can be properly sized, you may find the cost of a new energy-efficient system to be surprisingly affordable. In addition, the utility savings generated by this package of upgrades can either serve as payback on the initial investment or be used to cover the cost of other energy efficiency measures.

In multifamily buildings, the most common systems are:

- Heating and cooling (found in warmer climates)
- Split-system air conditioner with a gas furnace (forced air)
- Heat pump (through-the-wall or ducted)
- Water-sourced heat pumps (high-rise residential)
- Heating only (found in milder climates)
- Gas furnace (wall or forced air)
- Hydronic fan coil (forced air)

All these systems can be made more energy efficient by:

- Improving equipment effectiveness
- Correctly sizing the air conditioners
- Optimizing the design and installation of the duct system
- Reducing fan power in air handlers
- Ensuring adequate airflow over the indoor coil

High Efficiency HVAC Equipment

The simplest place to start when improving the efficiency of your HVAC equipment is with the ENERGY STAR® label. ENERGY STAR® products have gone through a certification process to be designated as energy efficient. Looking for the ENERGY STAR® label is a relatively quick and easy way of sorting through your purchasing options to identify those which can bring you the highest energy savings.

Even higher efficiencies are published by organizations such as the Consortium for Energy Efficiency (CEE). Their “Directory of ARI Verified Equipment” groups equipment into efficiency tiers and includes listings that are two levels higher than the ENERGY STAR® tier.

Correctly Sizing an Air Conditioner

One of the most common – and most costly – mistakes associated with air conditioning systems is the purchase of equipment that is oversized for the job at hand. Oversizing is common because vendors and building managers alike look at the installation of bigger equipment as a kind of safety net, a form of protection against future customer complaints about inadequately cooled rooms. There are also many “rules of thumb” and “ballpark” sizing methods that lead to overestimating the size needed for new equipment to be a good match for a building. Oversizing is, however, an expensive mistake, in terms of both the inflated initial investment in new equipment with unnecessarily large capacity, and the extra costs of running the oversized equipment in the years following its installation.

The efficiency of cooling and heating equipment is based on properly sized equipment. When any type of HVAC equipment is oversized, there is a significant compromise to its efficiency for several reasons. First, the equipment cycles on and off more often (short cycling), which increases wear and tear and in the end, raises maintenance costs and reduces life expectancy. In addition, short cycling equipment uses an oversized fan that blasts cold or hot air through the system in spurts, creating uncomfortable drafty conditions and unnecessary noise. Conversely, right-sized systems are able to supply a more even provision of heating and cooling, with quieter operation.

A high SEER/EER air conditioner connected to a leaky duct system can produce an overall energy performance inferior to that of a lower SEER/EER air conditioner connected to a tightly sealed duct system.

Along with all these improvements in comfort, properly sized equipment also yield significant energy savings. Switching from an oversized to a right-sized system can reduce energy usage by as much as 35 percent.¹

Duct Sealing

The equipment itself is only one part of the equation that applies to developing an energy-efficient HVAC system. No matter how efficient the equipment is, if the distribution system is not

well designed or does not operate properly, then the HVAC system as a whole will not be efficient. A high SEER/EER² air conditioner connected to a leaky duct system can produce an overall energy performance inferior to that of a lower SEER/EER air conditioner connected to a tightly sealed duct system. Installing new heating or cooling equipment does not negate the necessity of sealing air distribution ducts, and in fact only highlights

the need for careful maintenance of a distribution system in order to optimize the savings potential of your new equipment. And, duct sealing is actually a relatively inexpensive measure to implement,

especially considering how effective it is for improving HVAC system efficiency.

5.4 WATER HEATING

Residents place high value on hot water that is reliable and arrives quickly. Unfortunately, many of the hot water systems installed in multifamily buildings today suffer from unreasonable temperature fluctuations and slow delivery times. These problems lead directly to resident complaints and maintenance costs, as well as wasted energy and wasted water.

¹ “Residential HVAC” available at www.cee1.org/resid/rs-ac/rs-ac-main.php3

² SEER stands for Seasonal Energy Efficiency Ratio, which is an efficiency measurement for air conditioners.

Central Systems and Recirculation Loops

Central systems are usually the best option in multifamily buildings, for several reasons:

- One large heater or boiler is cheaper to purchase and install than many small ones, and saves space in each dwelling unit.
- Larger heaters and boilers are more energy efficient than smaller ones.
- Recirculation loops give residents quick access to hot water at a constant temperature.
- Maintenance for central systems is easier and more convenient.
- Systems can be located in a basement or other area that minimizes water damage in the event of a leak.

Central systems take two forms—trunk-and-branch systems, and recirculation systems. In larger buildings, recirculation loops are typically used because they provide hot water to residents more quickly than trunk and branch, because they are cheaper to install, and because they are more energy efficient.

Constant recirculation wastes a lot of energy, however, and increases maintenance costs related to the pump and copper piping. The standard approach to addressing this issue is the installation of a time clock control to automatically switch off the recirculation pump during the hours when hot water is not usually required. There are also additional controls that can be added to save more energy, improve the level of service to residents, and provide feedback to the building manager, and these are described below.

Demand Controls

In this type of control system, the recirculation pump is managed so that it only circulates water through the loop when there is demand from residents and the loop water is below a threshold temperature. This minimizes the amount of time for which the pump is switched on, and also minimizes heat loss from water in the loop. These systems are especially effective in small buildings where there are likely to be long periods with no hot water demand.

Temperature Modulation Controls

With this control, the temperature of the water in the storage tank is modulated so that it can be set on high during periods of peak demand, and remain at a lower temperature when there is typically low demand (for instance, overnight). This type of system may be especially helpful in the detection of faults such as leaks, crossover flows and pump failure.

Pipe Insulation

Pipe insulation is a very low cost measure that allows your system to deliver hot water more quickly at a higher and more consistent temperature, while saving energy. A length of un-insulated pipe can result in a plug of cold water being carried into a dwelling unit, prompting resident complaints and leading to long wait-times for hot water. It is therefore important to insulate the whole length of hot water piping in a building, whether a trunk-and-branch system or a recirculation loop is used.

Water Heater and Boiler Efficiency

Energy performance specifications allow designers and purchasers to directly compare the energy performance of different products. Products that have higher efficiencies will usually have lower fuel costs.

Different energy performance specifications are used for water heaters than for boilers. This is because storage water heaters are tested as a complete package, whereas central systems can have components that are mix-and-match. Water heater performance is typically described by an energy factor (EF) while boiler performance is rated by thermal efficiency or by annual fuel utilization efficiency (AFUE). Both EF and AFUE have been determined by U.S. Department of Energy test procedures and can be used in conjunction with local fuel costs to estimate the annual cost of operation. However, because they are calculated using different test procedures, it is not possible to directly compare EF values with thermal efficiency or AFUE values.

That being said, there is a way to evaluate the energy use of water heaters and that of boilers, through energy modeling software. The results are reported in terms of annual Btu consumption, and typically are generated for the purposes of code and program compliance modeling.

Water heaters are available in two basic forms with and without storage tanks. Storage tanks are used to meet peak demand (such as for showers in the morning) by holding an ample supply of hot water. Tankless (instantaneous) heaters must be able to meet this demand without the benefit of storage, and therefore have larger burners.

Tankless heaters currently have a higher initial cost, but have a number of advantages over storage water heaters:

- They occupy less space than storage heaters.
- They do not require periodic cleaning of the sediment that settles to the bottom of tanks.
- They provide unlimited hot water.
- Tankless heaters are more modular, so parts can be replaced more easily.
- They typically have a higher energy-efficiency factor (around 0.80 instead of 0.65), because the heater supplies water only when needed.

Solar Water Heating

Solar water heating is a mature technology that is almost always cost effective in sunny climates, and carries the additional benefit of reducing cooling load by shading the roof from hot summer sun. Solar systems are especially cost effective for larger buildings. A great variety of solar systems are available, and most can easily be integrated with a gas-fired central system so that peak loads are met even when there is no sun.

5.5 LIGHTING AND APPLIANCES

Lighting Fixtures

The simplest way to save on lighting costs is to swap incandescent light bulbs for compact fluorescent bulbs (CFLs). CFLs today come in all shapes, sizes and color temperatures, meaning they are now capable of producing light characteristics similar to their inefficient predecessor. CFLs use about one-third the amount of energy of incandescent bulbs and last up to 10 times longer, and so are a quick and cost-effective option for increasing energy efficiency in homes and common spaces.

Replacing T-12 lamps and magnetic ballasts with T-8 lamps and electronic ballasts is another easy way to save energy and money. In addition, T-8 lamps are quieter, more efficient and have a more pleasant color rendering.

ENERGY STAR® qualified fixtures (including ceiling fans with lights) must not only pass specific requirements related to energy efficiency, but also meet color temperature criteria and demonstrate even distribution of light. Replacing old lighting fixtures with ENERGY STAR® fixtures can save up to 75 percent of the energy used for lighting, and is also likely to improve the aesthetics of your building or home.

ENERGY STAR® Appliances

Refrigerators

Replacing a refrigerator purchased before 1993 with a new one that is ENERGY STAR® qualified can cut refrigerator energy consumption by 50 percent, without sacrificing automatic ice makers and through-the-door ice dispensers. High efficiency compressors, superior insulation and more accurate temperature and defrost mechanisms increase the performance of these newer units. Top freezer models generally yield an additional 7-13 percent energy savings over side-by-side models.

There are several other ways to save energy that can be implemented with refrigerators of any age and style. These include positioning the refrigerator away from any heat source, such as a dishwasher or oven, and out of direct sunlight; leaving a space between the refrigerator and the wall or cabinets to allow air to circulate around the condenser coils; and making certain the refrigerator and freezer doors seal tightly. You can also encourage residents

to set refrigerator temperatures between 35° and 38° F, and freezer temperatures at 0°F.

Dishwashers

Heating the water for a dishwasher consumes 80 to 90 percent of the energy needed to run it. Therefore, the most effective way to improve energy efficiency is reducing the amount of water used and thus, the volume needing to be heated. Newer models not only use less water, they can offer features such as streamlined motor designs, sensors that regulate the length of the wash, and built-in temperature boosters for more efficient water heating. All these improvements add up to significant reductions in water use when you replace dishwashers over 10 years old with an ENERGY STAR® qualified appliance.¹

Clothes Washers

As with other appliances, replacing old clothes washers is the best way to significantly impact your energy and water bills. New ENERGY STAR® qualified clothes washers require 50 percent less energy for operation than other new models,² and 40 percent less water than standard washers. They also extract more water from clothes during the spin cycle, which reduces clothes drying time and saves additional energy. When shopping for new washers, check the Modified Energy Factor (MEF) listed on each machine to learn the amount of energy it uses throughout the washing cycle. The higher the MEF, the more efficient the washer is.

¹ “Dishwashers” available at www.energystar.gov/index.cfm?c=dishwash.pr_dishwashers

² “Clothes Washers” available at www.energystar.gov/index.cfm?c=clotheswash.pr_clothes_washers

Pool Pump Replacement

Replacing an old, inefficient pool pump and controlling it with a timer to reduce operating hours can reduce pool pump use by 75 percent.¹ Smaller, right-sized pumps operate more efficiently and last longer than over-sized pumps. Typically, you can reduce filtration to six hours a day and still achieve sufficient circulation for keeping your pool clean while limiting energy use.

Augmenting your current power supply with renewable energy is easier and more practical than you may think.

A variable speed pump is another energy-saving option you may want to consider when replacing a pool pump. Variable speed capability allows the pump to operate at the minimum speed needed to accomplish its job with maximum efficiency.

5.6 PHOTOVOLTAIC INSTALLATIONS

Up until this point, the information provided in this section of the manual has focused on upgrades that save money as well as natural resources through optimizing your energy use. Now, however, we will consider the source of your energy; specifically, how augmenting your current power supply with renewable energy is easier and more practical than you may think. Significant advances have been made in solar energy technology and its application in recent years. These improvements continue to yield greater benefits, from enhanced equipment efficiency to quicker recoup of your initial investment.

Photovoltaic (PV) systems convert sunlight solar energy directly into electricity, typically through the installation of solar cells and PV arrays. Worldwide, the energy produced by these systems has doubled every year since 2002, and increased by 110 percent in 2008 alone.²

PV systems offer strong upgrade potential due to their ease of installation, maintenance and use, as well as their flexibility – it is relatively easy to add onto them as

needed. In multifamily buildings, a PV system can deliver energy specifically meant for common space areas (hallways, laundry rooms and lobbies as well as outdoor walkways and parking lots), or can be configured as a supplemental supply source for individual dwelling units as well.

The first step in exploring the possibility of harnessing solar power as a renewable energy source for your property is to complete all other energy-saving measures available to you. By minimizing the amount of energy you use and eliminating wasteful practices, your starting point for determining the scope of your PV upgrade will be as economically favorable as possible. After ensuring your site has reached its full potential for efficient energy use, any PV system you install will be able to supply a larger percentage of the energy load; or alternatively, you could choose a smaller system, spending less for your initial investment and saving more on operational costs in the years to come.

¹ “Installing and Operating a Swimming Pool Pump for Energy Efficiency” available at apps1.eere.energy.gov/consumer/your_home/water_heating/index.cfm/mytopic=13290

² “Solar Expected to Maintain its Status as the World’s Fastest Growing Energy Technology” available at www.socialfunds.com/news/article.cgi/2639.html

The second step is to accurately size a PV system to fit the building and grounds it will serve. This is critical because scaling the system correctly will have significant implications for both your startup investment costs and your ongoing energy savings. Factors that must be considered are the total amount of electric power needed, the extent of available roof space, and the level and location of shaded and sunny exposures. Not all existing projects are ideally situated for the use of PV panels. Projects with optimum orientation, roof slope and sun exposure are at a distinct advantage. A solar contractor should be able to estimate the energy generation potential of your site so your asset management team can make an informed decision.

The financial aspect of upgrading to a PV energy source can be daunting, but recent developments in marketing as well as government support for alternative energy have led to a diversity of new funding options. Many solar installation companies have come up with alternative payment methods that reduce upfront costs for solar installations. Some will install a system for free and charge the client a reduced rate for each kWh. Others will install a system with an agreement to claim rebate or tax incentive funds on behalf of the owner. What was once so cost prohibitive that it became nonviable for multifamily housing has now become achievable.

Along with options for funding the initial investment in a system, unique new approaches now exist for making PV-generated power produce ongoing financial rewards. Net metering is a policy many utility companies have adopted to pay customers who feed electricity they do not need

back into the grid. At times, a PV system will not generate enough electricity to handle onsite loads, and the electric meter operates as usual, counting the kilowatt hours drawn from the grid. Other times, the PV system produces more energy than the building or property consumes, causing the electric meter to run backwards. At the end of a billing cycle, the customer only pays for the net kWh drawn from the grid.

While net metering works well for owner-occupied and single-family housing, it is less feasible in multifamily and rental properties. One PV system with one converter typically covers an entire multifamily building, thus only one meter is used. In order for net metering to be applied in multifamily situations, an individual PV system would have to be installed for each dwelling unit so that each could have its own meter. However, the option of installing so many small systems is cost prohibitive and impractical.

Virtual net metering solves this problem. With virtual net metering, one meter measures energy fed into the grid, and other meters for individual dwelling units measure energy drawn from the grid. The PV system feeds energy straight into the grid rather than into the building, and the meter counts energy going in that direction only. At the end of the building cycle, the total credits for energy fed into the grid are divided amongst the residents, reducing the utility bill for each dwelling unit. This requires additional administrative labor from the utility company, but allows multifamily projects a chance to participate in solar incentive and deep energy reduction programs.

5.7 TOOLS

DOE Insulation Calculator

Find the appropriate levels of insulation for your climate zone with this easy-to-use web tool.

→ www.ornl.gov/sci/roofs%2Bwalls/insulation/ins_16.html

ENERGY STAR® Bulk Purchasing

Use this website to connect with suppliers who sell ENERGY STAR® qualified products in bulk and at discounted prices.

→ www.quantityquotes.net

5.8 RESOURCES

A Guide to Energy Efficient Heating and Cooling

This ENERGY STAR® publication describes how you can know when it's time to upgrade your heating and cooling systems, perform maintenance on your equipment, check your duct sealing, or work with a heating and cooling contractor.

→ www.energystar.gov/index.cfm?c=heat_cool.pr_hvac

CEE-AHRI HVAC Directory

CEE, the Consortium for Energy Efficiency, has a directory of energy-efficient HVAC equipment. The directory catalogues thousands of HVAC systems that qualify for CEE's residential and commercial HVAC initiatives.

→ www.ceeHVACdirectory.org

AHRI Directory of Certified Product Performance

The Air Conditioning, Heating and Refrigeration Institute (AHRI) directory is a great place to find certified heating and water heating equipment by type, size and efficiency.

→ www.ahridirectory.org/ahridirectory/pages/home.aspx

Energy Design Resources: HVAC Design

These design briefs and guidelines cover some of the major topics related to energy efficient HVAC.

→ www.energydesignresources.com/technology/hvacdesign.aspx

Additional Resources

California Lighting Technology Center (CLTC)
CLTC's mission is to stimulate, facilitate and accelerate the development and commercialization of energy-efficient lighting and daylighting technologies.

→ cltc.ucdavis.edu/

High Efficiency Water Heaters: Provide Hot Water for Less: Environmental Protection Agency (EPA), ENERGY STAR®

This document describes various water heating technologies, their efficiencies and estimated savings.

→ www.energystar.gov/ia/new_homes/features/WaterHtrs_062906.pdf

Understanding Solar Thermal Systems: Home Energy Magazine

→ www.homeenergy.org/article_preview.php?id=381&article_title=Understanding_Solar-Thermal_Systems

5.9 IDENTIFYING FINANCIAL RESOURCES

Planning a strategy to finance green affordable housing involves a significant amount of research due to the variety and complexity of financing programs and vehicles available today. There are policies that increase cash flow, Federal Energy Efficiency Tax Credits, and many other program incentives. The focus of their support ranges

from energy efficiency and solar/PV initiatives to green building practices, among others. Together, these mechanisms facilitate investments in high-performance buildings and facilitate gaining a return on that investment, while helping reduce design and technical assistance costs and increasing a project's net income. The key to accessing the right financing for your project is to thoroughly explore all the options, identify the appropriate combination of funding programs, and put your best administrative structures in place early in the process.

There are several categories of economic resources to help reduce the cost of the green design process and analysis, equipment, measures and materials:

- Green Financing
- LIHTC and Bond Financing
- Grants
- Government resources
- Utility Incentive Programs
- Utility Allowances
- Federal Energy Efficiency and Solar Tax Credits

5.10 GREEN FINANCING

More than ever before, banks and mortgage companies are responding to the housing sector's interest in environmentally aware building and business practices. They have responded with

Green Home Financing programs, created to support energy-efficient and conservation-minded housing through green mortgages and home equity packages, among other financial vehicles. When exploring your financing options, be sure to ask your lender if they have a green financing initiative that meets your needs.

5.11 LOW-INCOME HOUSING TAX CREDITS AND BOND FINANCING

Many states reward efforts to improve energy efficiency in affordable housing properties when

allocating funds through LIHTC and bond financing programs. Some offer competitive points and/or increased funding, while others provide a threshold basis boost. To qualify, projects typically need to meet a series of green criteria, such as

the use of ENERGY STAR® appliances, as part of fulfilling minimum rehab requirements.

5.12 GRANTS

Grants that support environmentally friendly approaches to rehab and building come from a wide variety of institutions and organizations. Aside from government agencies, nonprofit and private foundations from many different sectors offer funding assistance. Two of the most well known of these are:

- The Home Depot Foundation's Grant Program has granted millions of dollars to support a

The key to accessing the right financing for your project is to thoroughly explore all the options, identify the appropriate combination of funding programs, and put your best organizational structures in place early in the process.

variety of environmentally focused, nonprofit organizations throughout communities in the United States. Affordable Housing Built Responsibly is one of The Home Depot Foundation's funding program areas.

→ www.homedepotfoundation.org/housing.html

- Enterprise Community Partners: Green Communities provides grants, financing, tax-credit equity and technical assistance to developers who are creating low-income housing in accordance with The Green Communities Criteria.

→ www.greencommunitiesonline.org/

5.13 GOVERNMENT RESOURCES

State and local government agencies are prime resources for exploring the availability of special loans, grants and other programs that benefit green building practices. Your local building or planning department may also be able to provide you with



Sara Conner Court, Hayward, CA

information on green building requirements.

Examples of typical government programs are:

- State housing finance agencies may offer below market-rate loans through the sale of tax-exempt bonds.
- State Departments of Housing and Urban/Community Development (HCD) typically offer programs, loans and grants to housing authorities, affordable housing owners and developers, and service providers. HCDs can provide information on other financing resources as well.
- State and local waste, air and water boards may provide grants for funding green building design and construction practices related to their area of jurisdiction.
- Redevelopment agencies and housing authorities oftentimes provide competitive points for green building (and in particular, practices related to energy efficiency). Occasionally such points are required to qualify for funding.
- Local governments may also offer to streamline the process of applying for permits (reduced fees, fast tracking, etc.) when designs or plans that meet green building practices are submitted.

5.14 UTILITY AND PUBLIC INCENTIVE PROGRAMS

Some states have instituted a public goods charge whereby ratepayers are required to pay into a fund that is used to finance programs that promote energy efficiency and/or water conservation. To optimize your chances of qualifying to receive support, such as rebates or incentives, from one of these programs, identify their specific requirements before you finalize decisions concerning your upgrade or rehab. Look for specific information concerning appliance models or performance

thresholds; it is always easier to build these kinds of specs into your plans from the beginning, rather than try to accommodate them late in the process. If you need practical help or expert advice, utilities oftentimes will provide hands-on planning assistance to owners and managers investing in green rehab projects.

One resource for finding such programs is DSIRE, a comprehensive source of information on state, local, utility and federal incentives that promotes renewable energy and energy efficiency. However, searching through the DSIRE database should not take the place of directly contacting your local utility for up-to-date regional information.

→ www.dsireusa.org/index.cfm?EE=1&RE=1

5.15 UTILITY ALLOWANCES – OPTIONS FOR ENERGY EFFICIENCY

When energy efficiency measures are put into effect, residents can expect to benefit from lower utility bills. In recognition of this and to provide a mechanism for paying back investments in energy-efficient upgrades, such properties are granted lower utility allowances. These help owners and managers to boost cash flow and qualify for increased financing. The IRS allows owner/developers of Low-Income Housing Tax Credit properties to choose from five potential options for estimating resident utility costs:

- Public housing authority (PHA) utility allowance
- Local utility company estimate
- State agency estimate
- HUD's utility schedule model
- Energy consumption model

However, the energy consumption model is not available to buildings or residents receiving assistance from Rural Development, Section 8 or any other HUD regulated program.

Two of these options provide an opportunity for a lower (and more realistic) utility allowance schedule that more accurately reflects the post-rehab level of energy use after green upgrade and rehab measures have been implemented; these are Energy Efficiency-Based Utility Allowances and the Energy Consumption Model.

Energy Efficiency-Based Utility Allowance (EEBUA) Schedules

This option is PHA-driven, whereby in addition to the standard utility allowance, some PHAs offer a lower utility allowance for proven whole-building energy conservation (through energy building simulation models or third-party verification of a HERS rater). This Energy Efficiency-Based Utility Allowance (EEBUA) Schedule is also an average of consumption across the PHA jurisdiction's housing stock, with the caveat that it reflects the average energy-efficient project. Check with your local PHA before beginning a project to see if they offer such an allowance; if so, they will provide criteria to include as part of your planning process.

Energy Consumption Model

A 2008 IRS ruling allows LIHTC-funded projects to use an energy consumption model created with software approved by the agency administering LIHTC. A professional designated by the state's LIHTC allocating agency must be employed (at the cost of the property owner) to carry out the modeling, which takes into consideration building size, climate zone and energy efficiency measures

to create a project-specific basis for granting a utility allowance. Before you begin your upgrade project, check with your state's LIHTC agency to determine their criteria for qualifying projects, building simulators and software.

→ www.novoco.com/low_income_housing/lihtc/irs_guidance.php

5.16 FEDERAL ENERGY EFFICIENCY AND SOLAR TAX CREDITS AND DEDUCTIONS

Nonprofit developers are familiar with passing LIHTC credits to their for-profit investor partners, but many don't realize that energy efficiency and solar tax credits can be passed on a similar basis. Tax credits granted by the Federal Energy Policy Act of 2005 are available for both energy efficiency and solar energy projects implemented as part of both new construction and rehab projects. As you explore this opportunity and identify the tax credits applicable to your specific project, be sure to check with your tax expert to confirm your eligibility.

Energy Efficient Commercial Buildings Tax Credit (IRC Section 179D) High-Rise Buildings – New Construction

High-rise dwelling units (four stories and above) qualify for the same tax credits as do commercial buildings. If your rehab project allows you to achieve energy usage that is 50 percent more efficient than ASHRAE 90.1-2001, you will be eligible for tax deductions equivalent to \$1.80/square foot. Additionally, partial credits (\$0.60/square foot) can be taken for each component of a building's envelope (insulating, windows, etc.), lighting, or HVAC (heating and cooling system). Congress has extended the federal energy efficiency

tax credits through Dec. 31, 2013. To qualify, projects must be certified by a qualified HERS rater.

→ openpub.realread.com/rrserver/browser?title=/ASHRAE_1/ashrae_90_1_2007_IP_1280

Energy Investment Credit (IRC Section 48) For All Buildings

This law provides tax credits for solar energy, fuel cells and microturbines, small wind-energy systems, geothermal heat pumps, and combined heat and power (CHP) systems, and allows taxpayers to take the credits against the alternative minimum tax (AMT), subject to certain limitations. These credits were further expanded by The American Recovery and Reinvestment Act of 2009, enacted in February 2009.

Tax credits under this law are available for eligible systems placed in service on or before Dec. 31, 2016.

IMPORTANT NOTE: Because tax laws change frequently, seek professional tax advice on whether you qualify for any tax credits or deductions prior to implementing any measures..

5.17 TOOLS

Green Communities Checklist - Enterprise Community Partners

Whether or not you are participating in the Green Communities program, this checklist can provide guidance for the decisions involved in your upgrade projects.

→ www.greencommunitiesonline.org/tools/criteria/green_criteria_checklist.xls

5.18 RESOURCES***Citi Community Capital***

Citi Community Capital, a division of Citi, and Helio Micro Utility have created the first green energy sector fund of its kind, the Green Energy Community Investment Fund™. The program was established to initially finance up to four megawatts of solar electricity production in 2008, installed on qualifying commercial and public sector facilities throughout the U.S., with an emphasis on underserved communities.

The Green Energy Community Investment Fund was created to support the installation of solar electricity systems on commercial and public sector buildings.

→ heliomu.com/green-energy-community-investment-fund.php

Database of State Incentives for Renewables and Efficiency

DSIRE is a comprehensive source of information on state, local, utility and federal incentives that promote renewable energy and energy efficiency.

→ www.dsireusa.org

The Tax Incentives Assistance Project (TIAP)

This website is a great place to find updates on federal tax incentives. IRS forms are also available for download through this site.

→ www.energytaxincentives.org

Certification demonstrates that you have achieved specific green goals set for your property, as verified through third-party professionals, and that a building's performance is exemplary in terms of energy efficiency and sustainability.

Additional Resources

Making Affordable Housing Truly Affordable: Advancing Tax Credit Incentives for Green Building and Healthier Communities – Global Green

This report presents an analysis of the tax credit allocation policies of all 50 states and identifies existing green building

requirements for affordable housing projects.

→ www.globalgreen.org/i/file/qap_report_2006.pdf

5.19 INFORMATION RESOURCES

There are a number of resources available to support green asset management including guidelines, recognition and marketing programs and tools.

Guidelines

In California, Alameda County Waste Management, otherwise known as StopWaste, has come up with a number of useful guidelines for green building and asset management. Most significantly, StopWaste has been instrumental in supporting and funding the California-based Build it Green.

The U.S. Green Building Council (USGBC) has also recently produced guidelines concerning green residential retrofitting. REGREEN addresses the

major elements of any green renovation project, including the site of the home, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality. The guidelines blend product selection, building systems integration and proven technologies to create effective green strategies.

Certification and Recognition Programs

Participation in a certification program can be valuable in terms of both the financial rewards that result from achieving certification, and the environmental benefits generated by the green practices implemented to meet certification requirements. Certification demonstrates that you have achieved specific green goals set for your property, as verified through third-party professionals, and that a building's performance is exemplary in terms of energy efficiency and sustainability. For building owners and property managers who want this type of validation, there are both national and local programs to consider.

The U.S. Green Building Council's LEED for Existing Buildings: Operations and Maintenance Program was developed to recognize sustainability in the ongoing operations of existing buildings. The program includes consideration of energy and water performance improvements, cleaning products and plans, and recycling programs. Residential buildings that have four or more habitable floors are eligible to apply for certification under this program, but buildings must be in operation for at least 12 continuous months before they can be certified. More information on this

program is available at www.usgbc.org/leed/eb. The USGBC also has developed a guideline for home retrofit (described in the previous section).

In addition, there are local and regional green homebuilding programs that recognize sustainable renovations on existing residential structures. These programs may be found through local technical assistance providers, or by contacting Enterprise's Green Communities team at greencommunities@enterprisecommunity.org.

5.20 TOOLS

Building Profile Worksheet, REGREEN guidelines

The Building Profile Worksheet, found on pages 161-163 of USGBC's REGREEN guidelines, is a tool for documenting and analyzing information specific to your team's projects, including factors such as context details, building characteristics, building science issues and durability concerns related to various building types. With this array of data points, the team can determine priorities for addressing building performance in a holistic way.

→ www.regreenprogram.org

Green Rehabilitation of Multifamily Rental Properties: A Resource Guide

This document provides guidelines for multifamily affordable housing providers and their consultants on how to prepare a green physical needs assessment. It provides rehab recommendations that incorporate green building principles as they apply to energy efficiency, water conservation, resource conservation, and healthy indoor environments. The information in this guide, published by Bay Area

Local Initiatives Support Corporation and Build It Green, is applicable to both moderate rehab projects and substantial (or gut) rehabs.

→ www.nw.org/network/green/documents/LISCGreenRehabofMFGuide.pdf

Additional Tools

Green Multifamily Checklist: Scottsdale Green Building Program

These green criteria established for multifamily housing by the city of Scottsdale in Arizona can serve as a model for projects located in cities that do not yet have their own programs.

→ www.scottsdaleaz.gov/Assets/Public+Website/greenbuilding/GB_Multi-Family_Checklist.pdf

5.21 RESOURCES

Blueprint for Green Affordable Housing

This guide for housing developers, advocates, public agency staff and the financial community offers specific guidance on incorporating green building strategies into the design, construction and operation of affordable housing developments.

→ www.globalgreen.org/publications/

LEED Affordable Housing – U.S. Green Building Council

You can find a description of USGBC's affordable housing initiatives on this webpage. Details concerning their partnership with The Home Depot Foundation, which assists affordable housing projects meet LEED for Homes requirements for certification, may be of particular interest.

→ www.greenhomeguide.org/affordable/index.html

Additional Resources

Technology Roadmap: Energy Efficiency in Existing Homes – Volume Two:

Strategies Defined: Housing and Urban Development (HUD)

This document is one in a series of technology roadmaps created to help the housing industry make informed decisions about research and development investments.

→ www.huduser.org/publications/destech/tech_rdEnergy.html

Multifamily Green Building Guidelines: Alameda County StopWaste

Architects and project managers will find 63 recommended measures for green multifamily projects, along with eight case studies. Topics covered in the guidelines include identifying which measures are appropriate in specific development scenarios; choosing when in the project schedule to incorporate measures; the relative costs and benefits of individual measures; and where to look for additional technical information or materials.

→ recycle.stopwaste.org/mfdown/MultiFam.pdf



SECTION 6 CASE STUDIES AND BEST PRACTICES

Affordable housing managers around the country are pursuing innovative approaches to green asset management. For many, becoming immersed in a systems-thinking approach throughout the building's lifecycle has amounted to nothing less than an evolution of their standard business practices. By involving team members with a variety of expertise, asset managers are embracing a collaborative approach to instilling green practices in all phases of their construction and rehab projects—design, construction, operations and maintenance.

Through these efforts, organizations like First Community Housing in San Jose and Urban Edge in Boston have developed an internal knowledge base around green asset management. These groups and others have graciously offered to share their ideas and experience, and we will continue to build upon these resources as time goes on. These approaches can be applied whether you are self-managing or using third-party management. If you have additional resources or organizational lessons you would like to share as part of this toolkit, please contact Enterprise's Green Communities mailbox at greencommunities@enterprisecommunity.org.

6.1 TIPS FOR GREEN ASSET MANAGERS

Groups that have developed green asset management programs offer the following ideas:

- Assemble a team with representation from project management, construction management, asset management, property management, maintenance and finance.
- Develop a user-friendly system to measure and monitor building performance throughout the lifecycle. The system should be part of a feedback loop to influence future decisions about specific buildings and products in an organization's portfolio.
- Develop detailed operations and maintenance manuals for residents and property management to avoid losing critical information as a result of staff turnover.
- Use bulk and centralized purchasing systems, and vendors that provide quality green products or services at an affordable price. One way to manage this process is by selecting a group of vendors that you pre-approve through an RFP process and ensuring that the property management team sources products through these vendors.
- Use online bill paying to allow for ease in analyzing usage and cost data, particularly for utility bills.

- When developing new projects, use an integrated design process that begins during the pre-design phase and follows the building through its lifecycle; even include site inspections and check-in meetings with team members during operations and maintenance.
- Carry out building performance testing and inspections before and after major investments or upgrades.
- Engage in post-occupancy testing, including utilities usage and occupant quality-of-life surveys.

6.2 RESOURCES

Green Unit Turn: Seattle Office of Housing

This website provides a list of best practices in green operations and maintenance as gathered from experiences and recommendations of Seattle-based affordable housing owners and managers. The list features icons that provide a visual indication of the primary sustainability benefit associated with each option.

→ www.seattle.gov/housing/GreenUnitTurn/default.htm

Contact information

Contact information for the organizations profiled below is provided here. Asset managers may wish to tour these projects or speak directly with staff to develop ideas around improving their own green asset management approach.

Urban Edge

1542 Columbus Avenue, Suite 2
Roxbury, MA 02119
617.989.9300

→ www.urbanedge.org

First Community Housing

75 East Santa Clara St, Suite 1300
San Jose, CA 95113
408.291.8650

→ www.firsthousing.org/

Homeowner's Rehab

280 Franklin Street
Cambridge, MA 02139
617. 868.4858

→ www.homeownersrehab.org

6.3 CASE STUDIES

Urban Edge

Urban Edge (UE) helps to develop and sustain stable, healthy and diverse communities in Jamaica Plain, Roxbury, and surrounding neighborhoods in Boston. UE has developed and preserved over 1,360 units of affordable housing since its founding in 1974. Of these, 865 units have been developed as nine LIHTC projects. Five LIHTC projects are in Years 11-15 of the affordability period, and two are expected to close on their Year 15 disposition in 2009 and 2010. UE intends to retain ownership of all of its expiring tax credit projects for the benefit of its low- and moderate-income residents.

What makes UE stand out from many of its peers is its green Year 15 disposition approach. Noah Maslan, Director of Real Estate, describes an intense focus on driving down energy demand, identifying the most significant capital needs, and making residential units and buildings as healthy as possible. In all cases, UE evaluates significant capital needs options, such as HVAC and water consuming fixtures, with a Lifecycle Cost Analysis (LCA).

UE's goal is to navigate the tricky path of Year 15 reinvestment issues, arriving on the other side with a healthy balance sheet, healthy building and a healthy relationship with its residents.

Communication and investigation is crucial to this effort, and therefore UE is dedicated to collecting data and soliciting input about the physical needs

of the building from a variety of sources, including:

- A full review of utilities
- Residents' input gathered through questionnaires
- A review of work orders from the previous two years to identify major issues and establish consistency with residents' responses on the questionnaires
- Interviews with its third-party property management staff
- Energy modeling and infrared thermal imaging on the building, performed by qualified engineers

The most pressing capital needs are prioritized within the constraints of budget, codes and time.

Maslan and his staff include as many of the capital needs as possible in the reinvestment scope of work. High priority is given to items that decrease energy and water

use, improve residents' health, and address large capital items such as gutting a bathroom to address moisture issues, old plumbing, water use and mold. When necessary, UE temporarily relocates a family to another unit, but most rehabs are done with residents in place. Some less pressing, less disruptive items are scheduled for the operations budget of the next 15-year period.

Speaking with Maslan, one comes to learn the deep respect UE has for its residents. In its effort to be open and transparent, UE meets with residents

early in the process before any decisions have been made about improvements, and regularly thereafter. Incorporating residents in the reinvestment process has multiple benefits. No one knows a home better, including the maintenance and repairs it needs, than its residents. Understanding this helps UE make informed, cost-effective reinvestment decisions. Resident participation also helps reduce everyone's stress, builds trust and makes the process go more smoothly. It was from their surveys that UE learned its residents suffer disproportionately from respiratory diseases, most notably asthma. UE does its best to make the units as healthy as possible, which is good for all parties. Healthier, more comfortable residents are more likely to

report issues in the building, become better neighbors and pay their rent on time.

Rehab needs that are identified as both Year 15 reinvestment factors and subsequent

operations often can be addressed in several ways. Major capital items such as HVAC and windows are sent through a lifecycle cost analysis. According to UE's website, "Lifecycle Cost Analysis (LCA) is a method of evaluating a system or component's total cost by measuring its initial and future costs. It can be seen as the total discounted dollar cost of acquiring, operating, maintaining, repairing, disposing and replacing a material or system over a fixed period of time. The analysis is a useful method for evaluating alternatives that serve similar purposes but differ in their initial and future costs."

In its effort to be open and transparent, UE meets with residents early in the process before any decisions have been made about improvements, and regularly thereafter.

After the LCA, a decision might be made to retain those components with a long period of useful life still remaining, and to address them if they wear out in the next 15-year period. Or the analysis might come down on the side of replacement, in which case an alternative with a lower lifecycle cost will be selected. In all cases, the final decision is green by nature, favoring durable components that require less maintenance and have lower operating costs because they use less energy or water.

For more information about Urban Edge's green strategies and activities, visit:

→ urbanedge.org/green-housing.php

First Community Housing

As a large developer in San Jose, Calif., First Community Housing (FCH) has found that diversifying with multiple asset management companies has been a successful strategy. The organization uses three asset management companies to oversee its portfolio of more than 1,000 units among 14 projects.

Michael Santero, FCH asset manager, says the integration of green building into all phases of their projects has been a step-by-step learning process. The organization installed its first solar water heating system in 2000, and six years later completed its first LEED certified building.

Though Santero plays a key role in the

organization's green asset management strategy, he also noted the importance of a new position that was developed to oversee the work of the asset management companies. The Sustainable Facilities Manager's primary responsibilities are two-fold: 1) ensure the equipment is maintained properly and in line with FCH's sustainability goals, and 2) monitor the maintenance schedules for asset management. This staff person performs random site inspections to ensure maintenance is appropriately timed and contributes to improving building performance, which is particularly important for items such as HVAC filters and appliance cleanings.

FCH's approach to implementing comprehensive protocols for green operations and maintenance has evolved over time. Initially, they required asset

Carry out building performance testing and inspections before and after major investments or upgrades

management companies to use certain green building products. However, they eventually found it more effective to require compliance with certain product standards and

certifications, rather than specifying exact products.

This approach allowed the asset management companies to operate with more independence and creativity. It also resulted in a rich dialogue between the asset management companies and FCH around product performance and sourcing, ultimately leading to the selection of better-performing products. Another important aspect of FCH's green asset management strategy is its requirement that the operations and maintenance information is transferred to site managers and residents through manuals and trainings.

Homeowner's Rehab

Since its founding in 1972, Homeowner's Rehab, Inc. (HRI) has shifted its focus from homeownership to rental housing that is affordable for moderate- and low-income people in the Cambridge, Mass., market. HRI has developed over 1,500 housing units, and today owns and manages nearly 1,000. Green design has been incorporated into its new construction practices for over 10 years and more recently, HRI has trained its eyes on greening existing units with the "Greening of HRI Initiative."

Jane Jones, HRI's senior project manager, explains their four-pronged approach to promoting green building and living across their portfolio. The first is a capital upgrade improvement plan that involves using licensed engineers to conduct energy audits on a sampling of typical building types to improve energy efficiency and health conditions, and to increase green aspects of the housing stock. While the engineers focus on a building's envelop and systems, HRI staff assess individual units using a checklist for inspections, paying particular attention to air infiltration, water fixtures and non-ENERGY STAR® appliances and electric fixtures. With the audits, HRI:

1. Analyzes the mechanical, electrical and plumbing systems and identifies improvements to increase efficiency
2. Analyzes a building's thermal envelope to determine its efficiency and to identify opportunities for improving health conditions by controlling moisture and excluding pests, both factors associated with respiratory problems
3. Reviews landscape watering practices, irrigation systems and plumbing fixtures to improve water conservation

4. Reviews waste management practices during renovations and ongoing building operations with a goal of increased recycling
5. Reviews the current capital needs assessment for each building with a refocus on energy conservation and indoor air quality improvements

The second element of HRI's approach to green asset management is to identify and implement green and healthy property management practices. They define practices and identify products with minimal impact on resident health inside homes, and establish green maintenance practices to reduce any toxins inside homes and buildings. In the implantation process, HRI:

1. Assesses existing costs and standard maintenance practices with the intent of upgrading standards to include greener cleaning products and practices, and selecting healthier and more durable materials to use in unit turnovers and building renovations
2. Learns from the similar efforts of others, such as the Green Purchasing Program implemented by the City of Cambridge
3. Follows a program that helps reduce costs and brings a "one touch" green and healthy approach to building renovations and unit turnovers, repairs, pest control, and other ongoing maintenance, including measures for improving health and energy conservation while reducing toxins
4. Shares its materials and learning with other nonprofit groups who can benefit from the Greening of HRI Initiative

The third prong of HRI's approach focuses on resident education. Jones explains that once buildings are made more efficient and healthy for

the families living in them, resident education is critical. Residents are helped to use and maintain the buildings in a green fashion on a long-term basis. Teaching green living practices maximized the chances that the efforts HRI takes to green their properties are sustainable over time. HRI wants its residents to understand how they can make a positive impact on their own homes and within the broader environment. Their success has been demonstrated in concrete results; for example, the diversion of four tons of resident-generated material to recycling during a six-month resident education program in a 42-unit building where no previous recycling had been done.

HRI plans to sponsor workshops for its residents on energy efficiency, green living (e.g., non-toxic pest control and reduced household toxins), sustainability, climate change and recycling. Programs and workshops about the importance of the natural environment and energy conservation will be geared for residents, including the children.

The fourth and final strategy in the Greening of HRI Initiative is installing renewable energy systems where feasible. The ultimate accomplishment would be to create a net zero building that uses no energy from local utilities over the course of a year. Cogeneration to reduce heating

and cooling loads, solar water heating, and solar photovoltaic systems for producing electricity are among the technologies HRI uses or is considering.

Teaching residents green living practices maximizes the chances that the efforts HRI takes to green their properties are sustainable over time. HRI wants its residents to understand how they can make a positive impact on their own homes and also within the broader environment.

The Greening of HRI Initiative is launching by focusing on two properties, Oxford Street and Trowbridge Street, identified as two of the highest energy consuming buildings in HRI's portfolio. Both were built in 1935, and together contain 52 units. HRI currently

is completing an assessment of the mechanical equipment, water usage and electrical usage, after which improvements will begin in the areas that are deemed to be most critical to the environmental performance of each building.



SECTION 7 LIST OF ADDITIONAL RESOURCES

7.1 GOVERNMENT ORGANIZATIONS

U.S. Environmental Protection Agency (EPA)

→ www.epa.gov

- Links for New Homes
www.energystar.gov/index.cfm?c=new_homes.hm_index
- Home Renovations
www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_index
- Products
www.energystar.gov/index.cfm?c=bldrs_lenders_raters.pt_bldr
- Information for Home builders, Lenders, and Raters
www.energystar.gov/index.cfm?c=bldrs_lenders_raters.pt_bldr

U.S. EPA ENERGY STAR® Program

ENERGY STAR® is a government-backed program helping businesses and individuals protect the environment through superior energy efficiency.

→ www.energystar.gov

- ENERGY STAR® Homes Program
www.energystar.gov/index.cfm?c=new_homes.hm_index
- New ENERGY STAR® Homes Guidelines effective July 1, 2006
www.energystar.gov/index.cfm?c=bldrs_lenders_raters.homes_guidelns
- ENERGY STAR® New Homes Partners in California
www.energystar.gov/index.cfm?fuseaction=new_homes_partners.showStateResults&s_code=CA

- Resources for ENERGY STAR® Partners
www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_partner_resources

U.S. Dept. of Energy (DOE) Rebuild America

This organization provides energy-efficiency solutions for production housing.

→ www.rebuild.org

- U.S. DOE Energy Efficiency and Renewable Energy (U.S. DOE EERE)
www.eere.energy.gov/

U.S. Housing and Urban Development (HUD)

This site contains energy-related housing policy news and discusses the role that energy-efficiency plays in housing programs.

→ www.hud.gov

- Listing of HUD resources
www.hudclips.org/cgi/index.cgi
- U.S. HUD Multifamily Clearinghouse
www.hud.gov/offices/hsg/mfh/hc/mfhc.cfm

7.2 ENERGY-EFFICIENCY RESOURCES

American Council for an Energy-Efficient Economy (ACEEE)

ACEEE is a nonprofit organization dedicated to advancing energy efficiency as a means of promoting both economic prosperity and environmental protection.

→ www.aceee.org

- The Top-rated, Energy-Efficient Appliances
aceee.org/consumerguide/index.htm

Alliance to Save Energy (ASE)

ASE is a nonprofit coalition of business, government, environmental and consumer leaders supporting energy-efficiency resources and advocating energy-efficiency policies.

→ www.ase.org

- Resources for Home builders
ase.org/section/_audience/eprofessionals/builders
- Policy Document Library
ase.org/section/_audience/policy/library

American Solar Energy Society (ASES)

This is a national membership organization whose mission is to attain a sustainable U.S. energy economy by accelerating the development and use of solar and other renewable energy resources through advocacy, education, research and collaboration among professionals, policy-makers and the public.

→ www.ases.org

Consortium for Energy Efficiency

This site contains information on energy-efficient products for residential, commercial and industrial applications.

→ www.cee1.org/home.html

- The Residential Section
www.cee1.org/resid/resid-main.php3
- Clothes Washers
www.cee1.org/resid/seha/rwsh/rwsh-main.php3
- Home Appliances
www.cee1.org/resid/seha/seha-main.php3
- Lighting
www.cee1.org/resid/rs-lt/rs-lt-main.php3
- Whole House
www.cee1.org/resid/hp/hp-main.php3
- HVAC
www.cee1.org/resid/rs-ac/rs-ac-main.php3

Cool Roof Rating Council

Cool Roof is an independent organization which has established a system for providing radiative property data on roof surfaces that may improve the energy efficiency of buildings while positively impacting the environment.

→ www.coolroofs.org

Enercom's Energy Depot

→ www.energydepot.com

- Energy Library
www.energydepot.com/epcorcom/library/library.asp

EnergyGuy

Within this guide to selecting an energy professional is an abundance of energy-efficiency information, including a calculation tool for cost/benefit analysis of solar water heating.

→ www.theenergyguy.com

Florida Solar Energy Center (FSEC)

→ www.fsec.ucf.edu

- Building Science Basics
www.fsec.ucf.edu/en/consumer/buildings/basics/index.htm
- Building Research Publications List
www.fsec.ucf.edu/en/publications/publist.php?dept=br
- Home Designs
www.fsec.ucf.edu/en/consumer/buildings/homes/designs/index.htm

Southface

Southface promotes sustainable homes, workplaces and communities through education, research, advocacy and technical assistance.

→ www.southface.org

Global Green USA

Fosters a global value shift toward a sustainable and secure world through education, advocacy, partnerships and programs. Global Green USA website provides case studies, publications and information on energy-efficiency measures.

→ www.globalgreen.org

Integrated Building and Construction Solutions (IBACOS)

The goal of IBACOS is to help the homebuilding industry deliver high-performance homes that are designed and built to new standards of quality, including green criteria.

→ www.ibacos.com

Iris Communications

→ www.irisinc.com

- Green Building Source
oikos.com/index.php
- Iris Catalog of Energy-Efficient Products
oikos.com/green_products/index.php

Lawrence Berkeley National Laboratory (LBNL)

→ www.lbl.gov

- Home Energy Saver Calculator
hes.lbl.gov/

Low-Income Housing Rehabilitation for Sustainability and Affordability

A report prepared by the Portland Energy Office in 2000.

→ www.serapdx.com/resource/publ/Low%20Income%20Housing.pdf

National Fenestration Rating Council

This is a nonprofit, public/private organization created by the window, door and skylight industry providing ratings on window, door and skylight products.

→ www.nfrc.org

National Resources Defense Council (NRDC)

→ www.nrdc.org

- Affordable Green Housing
www.nrdc.org/cities/building/fhousing.asp
- Green Communities
www.greencommunitiesonline.org/

Partnership for Advancing Technology in Housing (PATH)

PATH promotes innovation in housing technologies.

→ www.pathnet.org

Rebuild America

This site provides general information about how energy affects various industries.

→ www.rebuild.org/index.asp

The Sustainable Building Sourcebook

Austin Energy's Green Building™ Sourcebook 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

U.S. Green Building Council (USGBC)

Information on the LEED (Leadership in Energy and Environmental Design) certification process is provided on this site.

→ www.usgbc.org

7.3 BUILDING AND ENERGY-EFFICIENCY NEWS

BuildingGreen.com and GreenBuildingAdvisor.com

BuildingGreen offers many publications, including *Environmental Building News* (www.buildinggreen.com/ecommerce/ebn.cfm?), the *GreenSpec* directory of green products (www.buildinggreen.com/ecommerce/gspec.cfm?), and the *BuildingGreen Suite* of online tools (www.buildinggreen.com/ecommerce/bgsuite.cfm?).

GreenBuildingAdvisor.com is dedicated to providing the most useful, accurate and complete information about designing, building and remodeling energy-efficient, sustainable and healthy homes.

→ www.greenbuildingadvisor.com

Home Energy Magazine

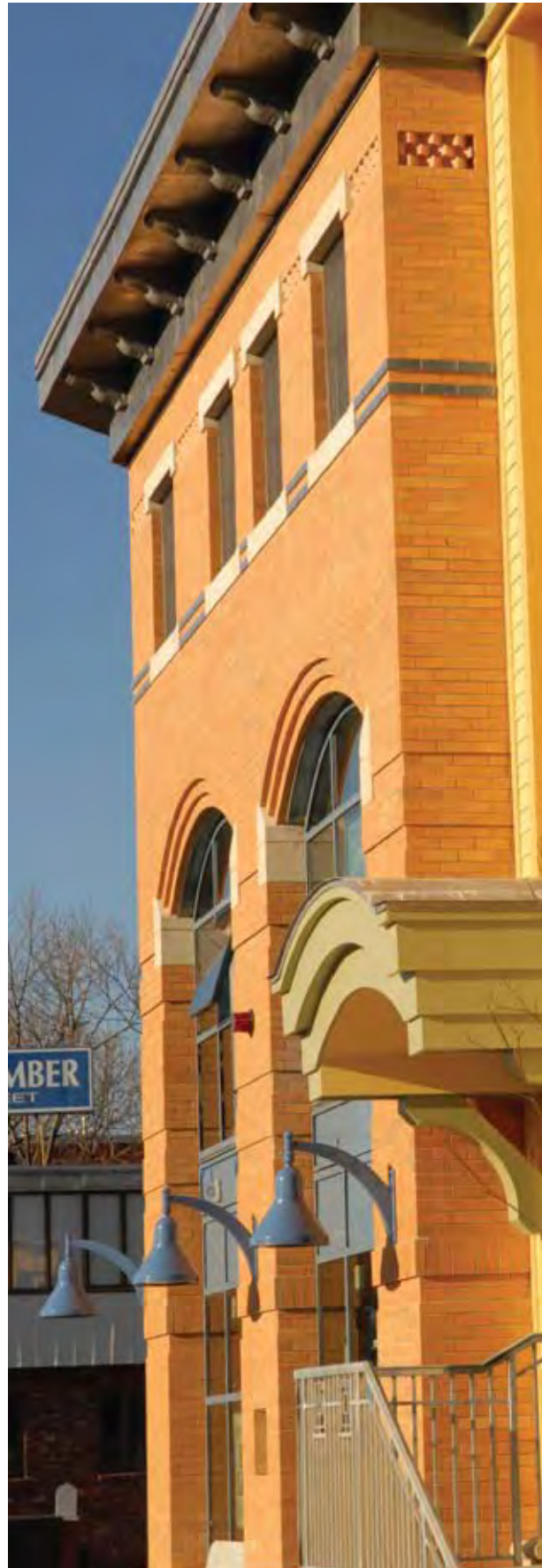
→ www.homeenergy.org

- A review of the most efficient boilers
homeenergy.org/archive/hem.dis.anl.gov/eehem/95/950909.html
- A review of the benefits of radiant barriers in attics
homeenergy.org/archive/hem.dis.anl.gov/eehem/92/920704.html
- Fuel use in multifamily buildings
homeenergy.org/archive/hem.dis.anl.gov/eehem/99/991112.html
- New guidelines for multifamily water heating
homeenergy.org/archive/hem.dis.anl.gov/eehem/96/960713.html
- Allocation of Energy Costs
homeenergy.org/archive/hem.dis.anl.gov/eehem/99/990714.html
- Green Products for Multifamily Rehab
homeenergy.org/archive/hem.dis.anl.gov/eehem/00/001114.html

Housing Zone

This site provides up-to-date news on the multifamily housing industry, including news related to green building.

→ www.housingzone.com



Trolley Square, Cambridge, MA

Appendix A: Audit Worksheet

Project Name _____ No. of units _____
 Building Number/Name _____ Area of corridors _____
 Total conditioned area for each building _____ Area of non-res spaces
 Areas of each apartment types _____ (reception, common room etc) _____

Building Shell					
Wall Construction	Type A	Type B	Type C	Type D	Type E
	Units No:	Units No:	Units No:	Units No:	Units No:
Wall Construction (wood, metal studs, ...)					
Size of framing members (2x4, 2x6, ...)					
Insulation Y/N					
Insulation Type (Batts, spray-on, ...)					
Thickness (in inch) or R value					
Radiant barrier or foil-faced batts (yes or no)					
Window Types	Type A	Type B	Type C	Type D	Type E
	Units No:	Units No:	Units No:	Units No:	Units No:
Type (Slider, Casement, ...)					
Number of Panes					
Dimensions of each window (W x H) (Ft-in)					
No. of such type of windows					
U-factor SHGC					
Frame Type (Vinyl, Wood, Alum., ...)					
Roof/Ceiling	Type A	Type B	Type C	Type D	Type E
	Units No:	Units No:	Units No:	Units No:	Units No:
Type of roof					
Insulation Y/N					
Insulation R value (or thickness)					
Insulation Type (batts, spray-on, ...)					
Radiant Barrier (Y/N)					
Cool Roof (Y/N)					
Lighting	Type A	Type B	Type C	Type D	Type E
	Units No:	Units No:	Units No:	Units No:	Units No:
Type of lighting (fluorescent, metal halide, incandescent)					
Magnetic or electronic ballasts					
Number of fixtures					
Number of lamps per fixture					
Notes to lighting					
Weather Stripping	Type A	Type B	Type C	Type D	Type E
	Units No:	Units No:	Units No:	Units No:	Units No:
Weather stripping Y/N					
Appliances	Type A	Type B	Type C	Type D	Type E
	Units No:	Units No:	Units No:	Units No:	Units No:
Refrigerator					
Cooking range					
Dish washers					
Washing machine					
Dryers					
Notes					

SECTION 8: APPENDIX

Appendix A: Audit Worksheet Continued

Project Name _____ Date _____

Building Systems & Equipment					
Air Distribution System	Type A	Type B	Type C	Type D	Type E
	Units No:	Units No:	Units No:	Units No:	Units No:
Forced Air by (heat/cool) equip.					
In conditioned space (Y/N/None)					
Duct insulation level					
Space Cooling Equipment	Type A	Type B	Type C	Type D	Type E
	Units No:	Units No:	Units No:	Units No:	Units No:
Type (package, split, PTAC, room)					
Manufacturer name					
Model Number					
Fan Size (HP/Amps) & Type					
Capacity (BTU-Hr)					
TXV (Y/N)					
Efficiency rating (SEER/EER)		SEER / EER	SEER / EER	SEER / EER	SEER / EER
Space Heating Equipment	Type A	Type B	Type C	Type D	Type E
	Units No:	Units No:	Units No:	Units No:	Units No:
Type (furnace, heat pump, fan coil)					
Inside Unit Manufacturer					
Inside Unit Model Number					
Fuel type (Gas/Electric/LP/Water)					
Fan Size (HP/Amps) & Type					
Capacity (BTU-Hr)					
Efficiency AFUE/HSPF/COP					
Pump Volts/Amps					
Pump Qty					
Combined Heat/DHW (Yes/No)					
DHW Equipment	Type A	Type B	Type C	Type D	Type E
	Units No:	Units No:	Units No:	Units No:	Units No:
Type (Central/Individual)					
Unit Manufacturer					
Unit Model Number					
How many DHW per building					
Fuel type (Gas/Electric/LP)					
Capacity (BTU-Hr)					
Efficiency (Energy)					
DHW Distribution System	Type A	Type B	Type C	Type D	Type E
	Units No:	Units No:	Units No:	Units No:	Units No:
Tank Capacity (gal) Insulation (R)					
Insulation (R-value) (internal/external)					
Pipe insulation btw. tank and wall					
Recirculation Control Type					
Recirc. Pump (HP/Amps) & Qty.					
Potential for solar DHW?					
Controls connected and working?					
Notes					

Appendix B: Data Release Authorization Form

DATA RELEASE AUTHORIZATION FORM

[organization name]

Your signing of this form authorizes [organization name] to access and utilize your past, current, and 60-month future energy/resource billing and consumption information/data so that it can effectively track the performance of your building's energy utilization systems in an effort to maximize their potential.

Property Information	Property Name _____			
	Property Address _____		City _____	State _____ Zip _____
	Contact Name _____	Contact Phone _____	Contact e-mail _____	
Utility Information	ELECTRIC	Electric Utility Company _____		Account Number _____
	Account Name _____	Account Mailing Address _____		City _____ State _____ Zip _____
	<i>Internet Account (if applicable):</i>	Username _____		Password _____
	NATURAL GAS	Natural Gas Utility Company _____		Account Number _____
	Account Name _____	Account Mailing Address _____		City _____ State _____ Zip _____
	<i>Internet Account (if applicable):</i>	Username _____		Password _____
	WATER	Water Service Provider _____		Account Number _____
	Account Name _____	Account Mailing Address _____		City _____ State _____ Zip _____
	OTHER Oil, Propane, Steam, etc.	Energy/Resource Provider _____		Account Number _____
	Account Name _____	Account Mailing Address _____		City _____ State _____ Zip _____

As an authorized representative of the property owner and customer listed above, [organization name] and/or its designated representatives are hereby authorized to access and utilize any and all information and data related to energy and/or natural resource consumption at the above listed property address. I understand that this information is being made available to help evaluate energy and resource use patterns in order to identify potential and actual energy savings resulting from work performed or services offered through [organization name]. The information/data obtained pursuant to the agreement shall be treated as confidential to the maximum extent permitted by law.

Signature of Authorized Representative _____

Date _____

Title _____

Appendix C: The Central Park Energy Flyover



THE CENTRAL PARK ENERGY FLYOVER

North East Denver Housing Center

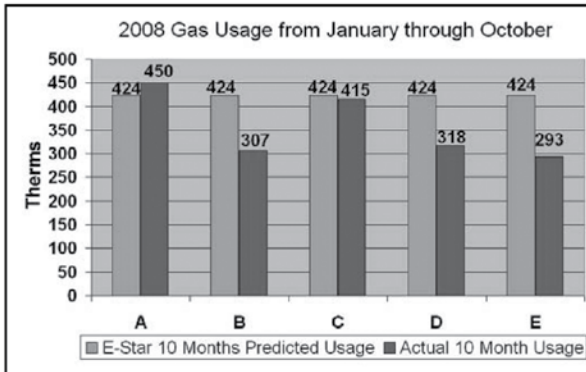
December Unit 101

How Much Energy Have You Used?

Our Central Park @ Stapleton community focuses on sustainability! What does this mean? A part of being sustainable means **SAVING ENERGY!!** Northeast Denver gave you a head start by installing many energy efficient measures. We also had energy raters estimate the amount your Gas (Therms) and Electricity (Kwh or Kilowatt Hours) usage before you moved in. We used this to determine how much energy you should be using over the past 10 months. The good news? Many of you have "beat" the estimates and are using less energy than predicted!! The graphs below allow you to see how YOUR unit compares to the estimate.

Blue = Estimated Usage and Purple = How much you have used and other identical units.

Natural Gas Usage from January 2008 to October 2008

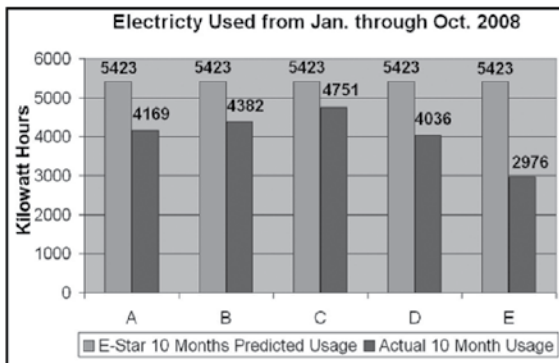


Your Unit A

Getting Better!! You have used 450 Therms, 26 more than predicted, but you have reduced the gap by 2 Therms since June.

Use the tips on the back of the newsletter to keep on saving energy!

Electricity Usage from January 2008 to October 2008



Of the 4169 kilowatt hours you used, 1861 kilowatts or 45% of your electricity was produced by the PV Panels on your roof. This 45% equals a savings of \$186.00.

Your Unit A

Great Job!! You have used 4169 Kilowatt Hours, 1,254 less Kilowatt Hours than predicted.

Here are a few Energy Tips to save even more:

- Turn off lights and TVs when you leave the house or a room for a long period of time
- Turn your dishwasher off during the dry cycle and let them air dry

Important Phone Numbers:

Maintenance Hotline:
303-377-6363

Continental Divide:
303-393-7368

Xcel Energy:
800-895-4999

Stapleton Master Community Association:
303-388-0724

Denver Police:
(Non Emergency):
720-913-2000

Park Hill Library
303-331-4063

Poison Control:
303-739-1123

Upcoming Event!!!

Gingerbread House Workshop!

Where: Cherry Creek Dance

When: Sat., Dec. 20th from 1-3 PM

What: Gingerbread House Decorating Sessions, Face Painting, and children's 'holiday' story time at Hermitage Bookshop

Cost: Free, but you have to register at events@cherrycreeknorth.com to participate



Two Ways to Save Money on Winter Heating Bills!

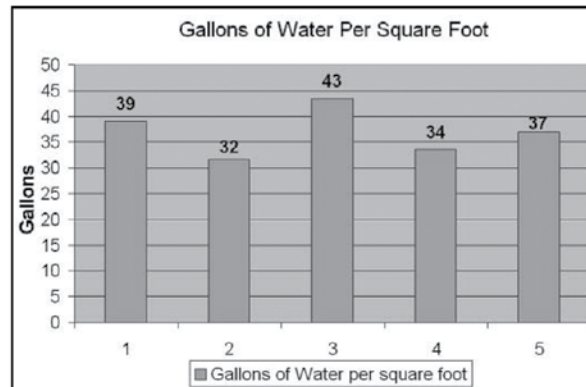
Use a Programmable Thermostat:

- Simply setting your house's temperature lower while you are away from home or at night will save a great amount of money.
- A programmable thermostat allows you to do this without having to worry about it each day
- Don't set or program the thermostat higher than you actually want it. It will not heat your house any faster
- If you go out of town, set your thermostat to a low temperature, yet high enough to keep pipes from freezing
- If you need any help programming your thermostat, please call Peter Rusin at 303-399-9337.

Use Cold Water when Washing Clothes:

- Use the cold water setting as much as possible
- Use hot water only for very dirty loads
- Always use cold water for the rinse cycle
- Run the washer with a full load

How Much Water Have You Used?



Your Unit 1

You have used a total of 57,773 gallons of water since January or 39 gallons per square foot of your living area. Some of your neighbors have been able to use a little less.

Tip: Turning off the water while washing your hands or brushing your teeth is a small step you can take to reduce your water consumption.

Cold Air Coming in Above the Kitchen Stove?



In November, Northeast Denver Housing Center and Frontier Mechanical went through each unit to investigate cold draft issues in each unit. One common problem has been the cold air coming into the unit above the stove. We have found a solution. The parts are on back order, but we will be installing them as soon as they arrive. This improvement will help to keep your unit more comfortable and lower your energy bill. If you have any questions on cold air entering the unit, please call Peter Rusin at 303-399-9337. For all other maintenance issues please call Continental Divide.

Appendix D: Sample View of Building Information Using Portfolio Manager

ENERGY STAR PORTFOLIO MANAGER [Account Information](#) [Contacts](#) [Frequently Asked Questions](#) [Contact Us](#) [Help](#) [Logout](#)

[Home](#) > [My Portfolio](#) > [Sample Multifamily](#) > **Add Multifamily Housing Space**

Add Multifamily Housing Space: Building A

Please provide values for each required attribute below. Values for optional attributes can also be provided, but they will not be used to generate an Energy Performance Rating. If the value you are providing is a **temporary value**, select the "For Temporary Use?" checkbox. Once the actual value is known, deselect this checkbox and provide the actual value. Facilities with temporary values may still apply for the ENERGY STAR.

If you wish for Portfolio Manager to provide **default values**, select the "Use Default Checkbox" for that attribute. Facilities that use default values cannot apply for the ENERGY STAR.

REQUIRED

Space Name:

*Required for Benchmarking

Space Attribute	Space Attribute Value <small>(Temporary values should only be used if an Actual value is not currently known) What is this?</small>	Use Default Value	Units	Effective Date (when this Attribute Value was first true) What is this? (MM/DD/YYYY)
*Gross Floor Area	<input type="text"/> <input type="checkbox"/> For Temporary Use?	N/A	Sq. Ft. <input type="text"/>	01/01/1983

Optional (not used for Benchmarking)

Space Attribute	Value	Units	Effective Date (when this Attribute Value was first true) What is this? (MM/DD/YYYY)
How many occupied or unoccupied apartment units does this building have?	<input type="text"/>	No Units	01/01/1983
Number of bedrooms that are located in each individual apartment unit	<input type="text"/>	No Units	01/01/1983
Number of Floors	<input type="text"/>	No Units	01/01/1983
Percentage of square footage that is devoted to occupied or unoccupied apartment units	<input type="text"/>	%	01/01/1983
Number of laundry hookups located in individual apartment units	<input type="text"/>	No Units	01/01/1983
Number of laundry hookups located in a common area that are either coin-operated or subsidized by the building owner	<input type="text"/>	No Units	01/01/1983
Number of dishwashers located in individual apartment units	<input type="text"/>	No Units	01/01/1983
Percent of the gross floor area that is heated	<input type="text" value="Select"/>	%	01/01/1983
Percent of the gross floor area that is cooled	<input type="text" value="Select"/>	%	01/01/1983
Indicate whether the facility is Affordable Housing (subsidized housing regulated by national, state, or local government), or Market Rate Housing	<input type="text" value="Select"/>	No Units	01/01/1983

Appendix D: Sample View of Building Information Using Portfolio Manager Continued

ENERGY STAR PORTFOLIO MANAGER [Account Information](#) [Contacts](#) [Frequently Asked Questions](#) [Contact Us](#) [Help](#) [Logout](#)

[Home](#) > [My Portfolio](#) > [Sample Multifamily](#) > **Enter Energy Use**

Enter Energy Use: Master Meter

Meter Information
 Fuel Type: Electricity (kWh)
 Space(s): Entire Facility
 Temporary energy data: Earliest Date through Present Date

Please enter the energy use for each meter entry below. Portfolio Manager requires that entries are for consecutive time periods; only one day of overlap or one day of gap can exist between meter entries to be eligible to generate an Energy Performance Rating.

If you are accounting for "sold" energy, indicate this by entering a negative energy use for the appropriate time period.

ENERGY STAR PORTFOLIO MANAGER [Account Information](#) [Contacts](#) [Frequently Asked Questions](#) [Contact Us](#) [Help](#) [Logout](#)

[Home](#) > [My Portfolio](#) > **Sample Multifamily**

Facility Summary: Sample Multifamily
[How do I use this page?](#)

Building ID: 1747350
 Level of Access: Building Administrator

Electric Distribution Utility: Kansas City Power & Light Co
 Regional Power Grid: [SPP North](#)
[Select my Power Generation Plant](#) to calculate my electric emissions rate
 Electric Emissions Rate (kgCO₂e/MBtu): 262.1 ([what is this?](#))

General Information [Edit](#)
 Address: 1234 First Avenue, Kansas City, MO 64106
 Year Built: 1983
 Property Type: Single Facility
 Baseline Rating: *N/A* Current Rating: *N/A*
 Eligibility for the ENERGY STAR
 Not Eligible: Rating must be 75 or above

Facility Performance [Set Baseline Period](#) | [Set Energy Performance Target](#)

Select View: [Performance](#) [Environmental](#) [Create View](#) | [Edit View](#)

12 Months Ending	Current Rating (1-100) More > (1-100)	Current Source Energy Intensity (kBtu/Sq. Ft.) More > energy intensity	Change from Baseline: Adjusted Energy Use (%) More information about change from baseline: adjusted energy use	Change from Baseline: GHG Emissions (MTCO ₂ e) More information about change from baseline: ghg emissions
January 2008	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
February 2008	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
Change			<i>N/A</i>	<i>N/A</i>

[Refresh](#)

Space Use [Add Space](#)

Space Name	Space Type	Floor Area (Sq. Ft.)	% Floor Area	Alerts
Building A	Multifamily Housing	80,000	100	>10% of Total Floor Space; Using temporary value for Gross Floor Area Delete Space more
Total		80,000	100	

Because more than 50% of your building is Multifamily Housing, your building is designated as Multifamily Housing within Portfolio Manager. This type of building is not eligible for an energy performance rating and does not have a reference national average ([Click to learn more](#)).

Due to rounding, the % Floor Area Total may not always equal 100%.

Energy Meters [Add Meter](#) | [Update Multiple Meters](#) | [View All Meter Data in Excel](#)

Meter Name	Energy Type	Space(s)	Last Meter Entry (End Date)	Alerts
Master Gas	Natural Gas (therms)	Entire Facility	12/31/2008	Data > 120 days old.; Temporary values used for meter entries. Delete Meter more
Master Meter	Electricity (kWh)	Entire Facility	09/30/2008	Data > 120 days old.; Less than one year of data.; Overlapping meter entries.; Temporary values used for meter entries. Delete Meter more

Water Meters [Add Meter](#) | [View All Meter Data in Excel](#)

Meter Name	Units	Use	Last Meter Entry (End Date)	Alerts
Master Water	Gallons	Indoor, Outdoor	12/31/2008	Delete Meter

General Facility Administration
[Track](#) Energy Performance Improvements
[Delete](#) this Facility from Portfolio Manager
[Contact us](#)

Sharing Data
[Add](#) user to share this Facility
[Modify](#) list of users
[Transfer](#) Facility to another user
[View](#) entire Access List for this Facility

Applying for the ENERGY STAR
[Apply](#) for the ENERGY STAR
[View](#) status of ENERGY STAR Applications

Building Profiles
 A building Profile can be created when an ENERGY STAR label application is submitted



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