



HUD Green Academy

Course 3

Best Practices for Building Operations and Maintenance

Syllabus

Course Summary

This course covers basic sustainable operations and maintenance (O&M) concepts for affordable housing. Participants will learn how to assess opportunities for greening operations, setting goals, and measuring performance for ongoing O&M, including energy and water saving opportunities. Concepts for purchasing and waste management as well as green cleaning and integrated pest management are also discussed. The importance of engaging occupants and providing resident education will be discussed. Finally, O&M concepts and practices will be applied through case studies and hands-on exercises.

Course Objectives

- Understand basic sustainable O&M concepts and practices in affordable housing.
- Explain how to measure and verify building performance
- Discuss effective purchasing and waste management.
- Learn green strategies for cleaning, landscaping, and integrated pest management.
- Learn how housing managers implement green repair programs.
- Identify tools to assist in resident education.

Module #1	Introduction to O&M Concepts and Practices
Module #2	Evaluating Building Performance
Module #3	Exercise - Green Unit Turn Over
Module #4	Maintaining Energy and Water Efficiency
Module #5	Exterior Maintenance and Landscaping
Module #6	Preventative Maintenance
Module #7	Operating Safe, Healthy and Accessible Housing
Lunch (1 hour)	
Module #8	Reducing Waste and Materials
Module #9	The Green O&M Plan
Module #10	Exercise - Green O & M Plan
Module #11	Resident Education and Engagement
Review and Course Evaluation	

Module 1

Introduction to O&M Concepts and Practices

Solution	Insights and Questions	Rate
Defining Sustainability		1. No Action 2. Planning 3. Forming 4. Developed
Importance of O&M		1. No Action 2. Planning 3. Forming 4. Developed
Need for an O&M Plan		1. No Action 2. Planning 3. Forming 4. Developed

What next steps can you personally take to incorporate sustainable O&M concepts and practices?

Timing	Next Steps	Resources/Info Needed
Short		
Short		
Medium		
Medium		

Module 2

Evaluating Building Performance

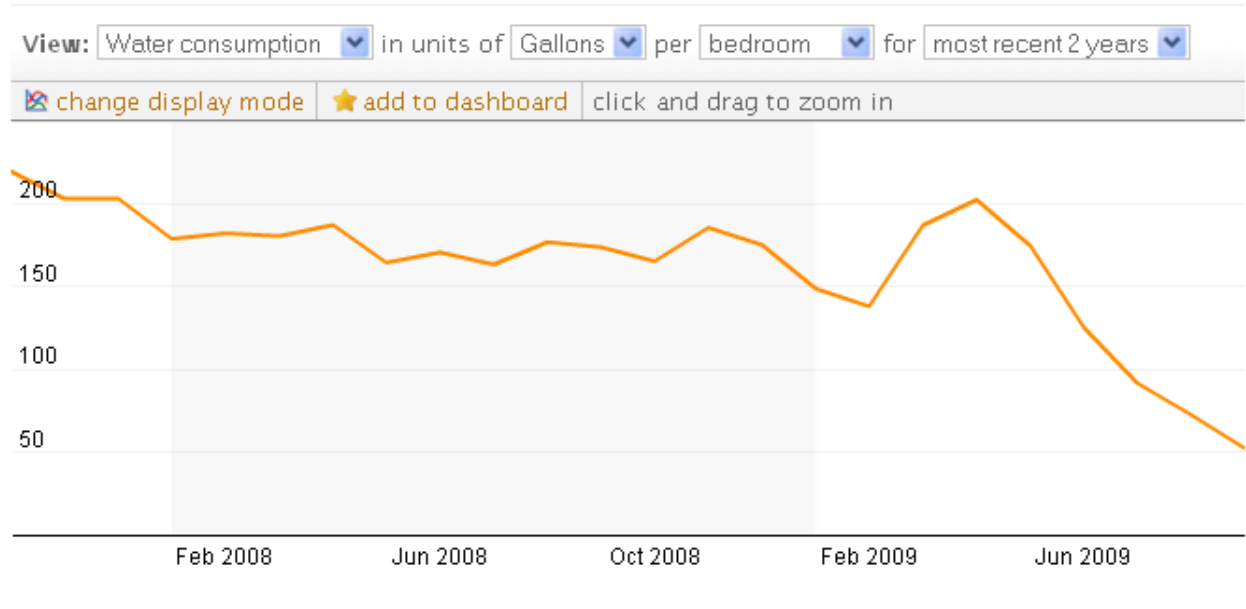
Solution	Insights and Questions	Rate
Benchmarking Tools		1. No Action 2. Planning 3. Forming 4. Developed
Data Collection and Analysis		1. No Action 2. Planning 3. Forming 4. Developed

What next steps can you personally take to improve the evaluation of building performance?

Timing	Next Steps	Resources/Info Needed
Short		
Short		
Medium		
Medium		

6 Unit Building in Boston

Water use in Gallons per bedroom (daily)



Benchmarking Natural Gas Use

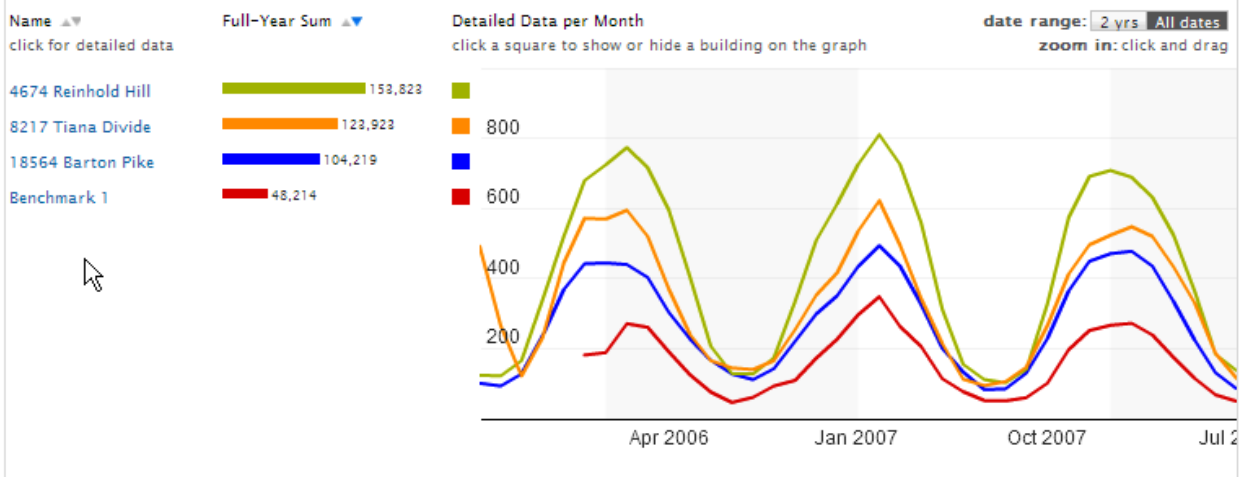
vs energy star

Custom Reports > vs energy star

View Report Edit Report Delete Report

Natural gas use in Btu per square foot

Show Raw Data Add to Dashboard



Exercise - Green Unit Turnover

Developing a methodology for efficiently preparing vacated apartments for re-occupancy is a critical component of every Operations & Maintenance Plan. It is also an opportunity to employ green strategies. Take 5 minutes to make a quick list of some of the green elements that could be included in a Unit Turn Plan. The instructor will tell you when to start the next part of the exercise.

1. _____
2. _____
3. _____
4. _____

Group List

Form a group with your classroom neighbors as instructed. Go around your circle and share the items on your Turn Over List. Next, work with your group for 15 minutes to develop a combined list using the following categories:

MECHANICAL

1. _____
2. _____
3. _____

APPLIANCES

1. _____
2. _____
3. _____

ELECTRICAL

1. _____
2. _____
3. _____

PLUMBING

1. _____
2. _____
3. _____

WINDOWS/ PATIOS/ PORCHES

1. _____
2. _____
3. _____

CLOSETS/ CABINETS/ SHELVING/ COUNTERS

1. _____
2. _____
3. _____

FLOORING

1. _____
2. _____
3. _____

MISC.

1. _____
2. _____
3. _____
4. _____

Next compare your list to that on the next two pages and add items you think should be included.



Apartment Turnover Checklist for HRI Portfolio: Make-Ready Units

Unit Number:	Move-out Date:	Move-in Date:
Inspection Date:	Inspected by:	Painting Date:
Date submitted to Maintenance:	Submitted to Maintenance by:	Carpet Replacement Date:
Turnover Completion Date:	Turnover Completed by:	Extermination Date:
Mechanical		
Check replacement reserve schedule for MEP Systems.		
Check thermostat function and set heat to 55 degrees or low setting.		
Check that air conditioner units are operative-follow A/C sleeve policy.		
Turn off all air conditioner units.		
Replace HVAC filters if applicable.		
Clean air conditioner grill(s)		
Check heaters for proper operation, including flue pipes. For Whalen units place tablet in condensate pan.		
Check & clean baseboard covers using green cleaning product. HEPA vacuum fins.		
Appliances		
Check to ensure refrigerator is Energy Star- if not, replace with Energy Star model		
Check to ensure dishwasher is Energy Star- if not, replace with Energy Star model		
Direct vent kitchen stove exhaust where possible.		
Set oven to required temperature for cleaning.		
Check operation of disposal.		
Soak refrigerator and stove parts as needed.		
Remove refrigerator condensate pan, wash and return to unit.		
Wash refrigerator inside and out using green cleaning product and HEPA vacuum coils.		
Wash refrigerator and stove parts using green cleaning product		
Clean floor and walls behind stove and refrigerator. Apply borate. Report pest activity.		
Clean stove top and ovens using green cleaning product		
Reassemble stove and refrigerator.		
Make sure stove and refrigerator are operating properly.		
Set refrigerator to lowest temperature.		
Check stove and pilot lights.		
Clean hood fan and filter using green cleaning product.		
Clean dishwasher using green cleaning product		
Electrical		
Check to ensure all light fixtures are Energy Star- if not, replace with Energy Star fixtures		
Clean light fixtures.		
Inspect GFI's, outlets and switches-clean plates.		
Replace any burned out bulbs.		
Hard Wire Smoke Detectors and test		
Hard Wire CO Detector and test		
Install Energy Star Panasonic fan/light w/ control where possible. If not, repair exhaust fan function		
Check door bell & intercom operation.		
Clean bath light and fan grills using green cleaning product. Check exhaust fan operation.		
Plumbing		
Check GPF of toilets- replace > 1.6 with Toto Eco Drake 1.28 GPF		
Check toilets for slow leaks using dye test; replace flapper if slow leak		
Check kitchen sink, bath tub + shower faucets for proper operation and aerators-shower <1.75 GPM		
Check under kitchen and bath sinks for leaks.		
Fill wall penetrations to prevent pest entry to unit.		
Caulk tub shower area and sink/backsplashes, if needed.		
Replace toilet seats, if needed.		
Clean sinks, toilets, baths, showers, tiles with green cleaning product.		

NOTES

1. _____
2. _____
3. _____
4. _____

Windows, Patios, Porches		
	Wash all windows. Check seals.	
	Caulk all windows, storms, rebalance, caulk and ensure operation.	
	Check weatherstripping on apartment front and rear entry doors and correct if needed	
	Check for operating storm door to any doors to exterior	
	Check shades/blinds for proper operation and appearance. Clean or replace.	
	If windows are south facing, contact HRI to discuss block out shade option	
	Check all traverse rods for proper operation. Repair or replace, as needed.	
	Clean patio door tracks.	
	Clean porch, deck or patio.	
Closets/Cabinets/Shelving/Counters		
	Make sure closet doors (especially bi-folds) open and close properly.	
	Make sure cabinets and draws open and close properly.	
	Clean shelving and make sure it is secure.	
	Clean doors, door tracks and interiors of closets, cabinets and draws.	
	Clean medicine cabinet and other mirrors.	
	Clean all counters.	
	Wipe all door jambs, sills and woodwork.	
Flooring		
	Remove all carpeting- buff and refinish wood flooring, use 3 coats of water-based polyurethane	
	Install resilient flooring (alternative to VCT) with plywood sub-flooring in kitchen.	
	Install tile in bathroom if not already installed	
	If wood flooring is not usable, install low pile, % recycled content carpet	
	Damp mop and wax all wood and non-ceramic tile floors.	
	Remove spots using green cleaning product and wipe clean all tile floors.	
	Vacuum carpeting and check for necessary repair.	
	Shampoo carpets. Ventilate the unit so the carpet can dry.	
	Wipe clean all base molding.	
Miscellaneous		
	Seal all entry holes/penetrations with caulk and fill larger holes with "Stuff-It"	
	Treat areas prone to insect infestation with borate or similar substance	
	Arrange for exterminator to inspect and exterminate the unit using the IPM program.	
	Paint all wall surfaces with low VOC primer and paint	
	Provide walk off mat or resilient flooring at apartment entry	
	Install child safety locks at kitchen and vanity base cabinets	
	Change exterior door and mailbox locks. Update maintenance file keys.	
	Remove all working materials and tools.	
	Perform final check for cleanliness.	
	Place welcome gift in unit and Save Green Brochure or Green Living Guide	
	Lock apartment door and deliver keys to office.	
Approved by Superintendent:	Approved by Manager:	Date:
Notes:		

HOW WILL YOU APPLY THIS TURN OVER EXERCISE TO YOUR WORK?

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Module 4

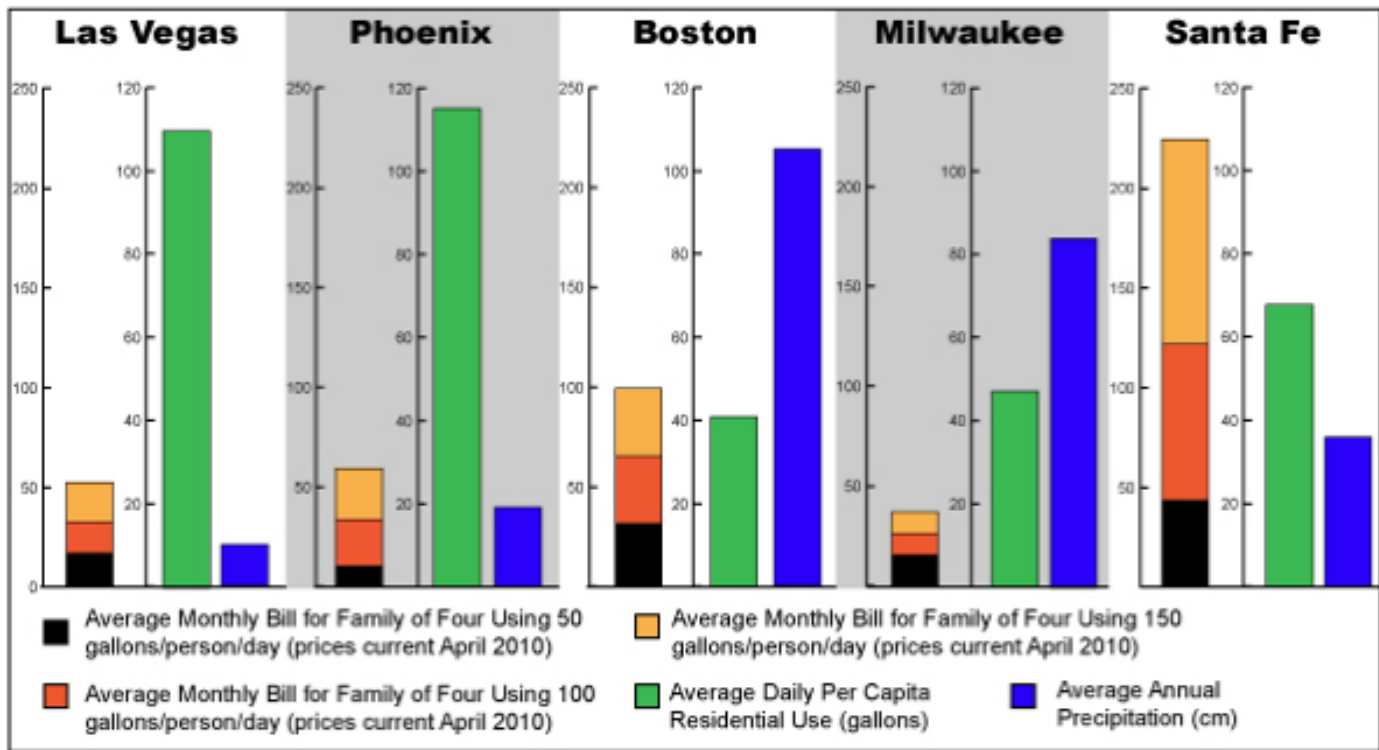
Maintaining Energy and Water Efficiency

Solution	Insights and Questions	Rate
Water Fixtures & WaterSense		1. No Action 2. Planning 3. Forming 4. Developed
Energy Star and HVAC		1. No Action 2. Planning 3. Forming 4. Developed
Thermal Envelope		1. No Action 2. Planning 3. Forming 4. Developed
Equipment Replacement		1. No Action 2. Planning 3. Forming 4. Developed

What next steps can you personally take to improve energy and water efficiency through maintenance?

Timing	Next Steps	Resources/Info Needed
Short		
Short		
Medium		
Medium		

Infographic: Water Use Comparison of 5 U.S. Cities



Graphic by Trevor Seela

Module 5

Exterior Maintenance and Landscaping

Solution	Insights and Questions	Rate
Landscaping and Shading		1. No Action 2. Planning 3. Forming 4. Developed
Paving and Roofing		1. No Action 2. Planning 3. Forming 4. Developed
Exterior Lighting		1. No Action 2. Planning 3. Forming 4. Developed
Equipment		1. No Action 2. Planning 3. Forming 4. Developed

What next steps can you personally take to improve exterior maintenance and landscaping practices?

Timing	Next Steps	Resources/Info Needed
Short		
Short		
Medium		
Medium		

Module 6

Preventative Maintenance

Solution	Insights and Questions	Rate
Tenant-Performed		1. No Action 2. Planning 3. Forming 4. Developed
Staff-Performed		1. No Action 2. Planning 3. Forming 4. Developed
Staff Training		1. No Action 2. Planning 3. Forming 4. Developed
Commissioning		1. No Action 2. Planning 3. Forming 4. Developed

What next steps can you personally take to improve preventative maintenance practices?

Timing	Next Steps	Resources/Info Needed
Short		
Short		
Medium		
Medium		

Module 7

Operating Safe, Healthy and Accessible Housing

Solution	Insights and Questions	Rate
Indoor Air Quality		1. No Action 2. Planning 3. Forming 4. Developed
Green Cleaning		1. No Action 2. Planning 3. Forming 4. Developed
Integrated Pest Management		1. No Action 2. Planning 3. Forming 4. Developed
Health Problems		1. No Action 2. Planning 3. Forming 4. Developed

What next steps can you personally take to improve safety, health and accessibility?

Timing	Next Steps	Resources/Info Needed
Short		
Short		
Medium		
Medium		

Module 8

Reducing Waste and Materials

Solution	Insights and Questions	Rate
Building Waste Recycling		1. No Action 2. Planning 3. Forming 4. Developed
Purchasing		1. No Action 2. Planning 3. Forming 4. Developed

What next steps can you personally take to reduce waste and material use?

Timing	Next Steps	Resources/Info Needed
Short		
Short		
Medium		
Medium		

Module 9

The Green O&M Plan

Solution	Insights and Questions	Rate
Elements of an O&M Plan		1. No Action 2. Planning 3. Forming 4. Developed
Integrated Design		1. No Action 2. Planning 3. Forming 4. Developed
Contractor Qualifications		1. No Action 2. Planning 3. Forming 4. Developed
Green Product Labeling		1. No Action 2. Planning 3. Forming 4. Developed

What next steps can you personally take to implement a Green O&M Plan

Timing	Next Steps	Resources/Info Needed
Short		
Short		
Medium		
Medium		

Module 10

Exercise - Prepare a Section of a Green O&M Plan

You'll be assigned one of the following roles by counting out:

1. Community Development Corporation (CDC) Director of Maintenance
2. University Sustainability Program Director
3. Greenest Foundation Program Officer
4. Mayor

You've been invited to an important meeting to discuss a joint venture to advance cutting edge sustainability in your community.

The CDC will soon be assuming management and ownership of a 200-unit low-income apartment complex built in the 1960s that was recently foreclosed for back taxes. You've been asked to bring one idea to the meeting for a project that will engage the University, the CDC, the City and the Dream Foundation in a joint venture to advance the Green O&M Plan for the property.

The proposed project must include the following elements:

- Show measurable benefits
- Engage at least 30 students and a faculty member for 10 hours per week each semester
- Be able to start with \$45,000 per year in grant funds and run for the next 5 years
- Be ready to start in 2 months

This is an imaginary exercise so feel free to make up project details to support your idea. For example, the University has the world's leading expert in composting or the City staff includes weatherization experts or the CDC has agreed to finance green strategies with proven payback. Don't worry if you have difficulty coming up with a plan in the short time allowed for the exercise.

Following is the table of contents from the CDC's draft O&M Plan (which was adapted from the Enterprise O&M Template).

Green Operations & Maintenance Manual for Your Dream Project

Best Practices for a Healthy and High-Performance Building

TABLE OF CONTENTS

I. Green Operations and Maintenance Guidelines

- A. Indoor Air Quality Management
- B. Green and Healthy Housekeeping
 - Cleaning Procedures
 - Low-Toxic Cleaning Products
 - Storage and Disposal of Cleaning Products
 - Disposable Janitorial Supplies
 - Housekeeping Equipment
- C. Indoor Pest Prevention and Control
 - Integrated Pest Management
 - Pest Prevention
 - Bed Bug Prevention
- D. Waste Reduction and Recycling
 - Waste Prevention
 - Building Rehabilitation / Renovation Waste Management
 - Hazardous Waste Disposal
 - Recycling

- E. Energy and Water Conservation
 - Energy Efficiency Strategies
 - Water-Saving Strategies

- F. Green Groundskeeping
 - Irrigation
 - Plantings
 - Integrated Pest Management
 - Stormwater Filtration
 - Exterior Lighting
 - Garage / Parking Lot

II. Green Materials and Systems

- A. List of Green Components
 - Systems and Equipment
 - Exterior Materials
 - Interior Materials, Finishes and Furnishings
- B. Green Product Summaries with Maintenance Guidelines
 - TBD
 - Roof Coating
 - Linoleum Flooring
 - Bamboo Flooring

Appendix

- Design team directory
- Mechanical Filter Replacement Schedule
- Lighting Maintenance and Lamp Schedule
- *Flooring Maintenance Guide*
- *Integrated Pest Management (IPM) Training Manual*
- Reduced-Risk Pesticide List
- Recycling Collection poster
- Hazardous Wastes information sheet

TAKE 10 MINUTES TO MAKE NOTES ON YOUR INITIAL IDEA:

1. _____
2. _____
3. _____
4. _____
5. _____

WHEN THE INSTRUCTOR INDICATES, ASSEMBLE IN GROUPS OF ABOUT 8-10 PEOPLE FOR A 35-MINUTE DISCUSSION.

1) FIRST, TAKE TURNS QUICKLY TO PITCH EACH GROUP MEMBER'S IDEA. PLEASE DON'T PROVIDE FEEDBACK AT THIS TIME. IT IS OKAY TO PASS. AS OTHERS SPEAK TAKE NOTES ON THE ASPECTS OF THEIR IDEAS YOU MOST APPRECIATE. (10 Minutes)

- _____
- _____
- _____
- _____

2) NEXT, TAKE TURNS DESCRIBING QUICKLY HOW YOU WOULD LIKE TO SUPPORT ONE OR MORE IDEAS ADVANCED BY ANOTHER GROUP MEMBER. IT IS OKAY TO COMBINE IDEAS. (10 Minutes)

- _____
- _____
- _____
- _____

3) TRY TO REACH CONSENSUS ON A SINGLE PROJECT. (10 Minutes)

- _____
- _____
- _____
- _____
- _____

4) BE PREPARED TO REPORT OUT TO THE GROUP

5) AFTER REPORTING OUT, REFLECT IF THERE IS A WAY TO APPLY THIS EXERCISE TO YOUR WORK. (For example, is there an opportunity for a service - learning workshop, a partnership, another approach to maintenance, TA that could be provided, further research etc.?) LIST YOUR IDEAS BELOW.

- _____
- _____
- _____
- _____
- _____

Module 11

Resident Education and Engagement

Solution	Insights and Questions	Rate
Resident Orientation		1. No Action 2. Planning 3. Forming 4. Developed
Resident Recycling		1. No Action 2. Planning 3. Forming 4. Developed
Green Incentives		1. No Action 2. Planning 3. Forming 4. Developed
Resident Initiatives		1. No Action 2. Planning 3. Forming 4. Developed

What next steps can you personally take to improve resident education and engagement?

Timing	Next Steps	Resources/Info Needed
Short		
Short		
Medium		
Medium		

Green Affordable Housing Action Plan

My vision for the role of sustainability in advancing the mission of my organization is:

In order to advance this vision, within the next **three months** I will:

As a first step to achieving this vision, within the next **two weeks** I will:

I will measure the success of this effort over time by:

Upon returning to work, I will reach out to in order to:

Organization or Person _____

I will also explore resources or partnerships that will enable me to:

Insert Goal or Intent _____

Possible additional Next Steps to incorporate green building and sustainability into your work and your agency:

- Gather and enter utility data for an existing building into Portfolio Manager or another third party energy benchmarking program (e.g. WegoWise, EnergyScoreCards)
- Contact local utility for information on residential energy efficiency programs and incentives (including energy audits)
- Conduct a healthy homes assessment
- Sign up for additional training towards a green building or healthy housing certification (e.g. LEED AP, BPI, NHCC)
- Organize or participate in an integrated design charrette for a current project
- Revise internal procurement policies to emphasize green cleaning products
- Contact a local green building or environmental nonprofit to conduct an energy audit for a residential property or administrative office
- Download the Enterprise or other green O&M Manual and create/customize an O&M Plan for all residential properties
- Start or expand a recycling program in your local office (paper, plastic, metals, toner cartridges and electronic equipment)
- Engage residents to help implement a recycling program in existing residential properties
- Replace existing light bulbs with energy-efficient compact fluorescent bulbs in the common areas of a residential property or in an administrative office
- Establish a resident education program to reduce energy and water use, improve occupant health, and encourage recycling (perhaps partner with a nonprofit, university, or other partner)