Introduction to Green Building for Affordable Housing

HUD GREEN ACADEMY

Course 1

Funding for this educational program is provided by the U.S. Department of Housing and Urban Development

Shaun Donovan, Secretary

HUD Green Academy Training

- Course 1 — Intro to Green Building for Affordable Housing
- Course 2 — Executive Decision-Making
- Course 3 — Best Practices for Building Operations and Maintenance
- Course 4 — Financing Green Building
- Course 5 — Energy Performance Contracting for Small PHAs

Course Summary

This course provides an introduction to energy efficiency and green building for HUD grantees, affordable housing practitioners and participating jurisdictions.

Day One explores the elements of green building and operations including efficiency, healthy housing and organizational sustainability. HUD rules are discussed and case studies are included.

Day Two is an interactive affordable housing design charrette exercise.

Course Content

- Overview of green building concepts and sustainability
- Presentation of green building standards and HUD incentives
- Integrated design and development exercises
- Sustainable operations and maintenance strategies
- Organization-wide commitment and planning

Agenda

DAY ONE

•Module 1	Green Building and Sustainability
•Module 2	Location Efficiency and Site Design
•Module 3	Water Conservation
•Module 4	Resident Health, Safety and Accessibility
•Module 5	Materials and Resources
LUNCH	
•Module 6	Energy Efficiency
•Module 7	Operations and Maintenance
•Module 8	Organizational Sustainability
•Module 9	Green Building Standards and Codes
•Module 10	Reflection and Day One Synthesis Exercise

Agenda

DAY TWO

- **Module 11 Integrated Design Workshop**
- **Reflection and Course Evaluation**

Module 1

Introduction to
Green Building and Sustainability

Module 1

HUD promotes conservation, including
•energy efficiency,
•renewable energy,
•water conservation,
•reduction of environmental impacts,
•waste minimization and
•the creation of a healthy and comfortable living environment

Introduction to Green Building and Sustainability

HUD's

PRIORITY GOAL 1: FORECLOSURE PREVENTION

PRIORITY GOAL 2: RENTAL ASSISTANCE

PRIORITY GOAL 3: VETERANS HOMELESSNESS

PRIORITY GOAL 4: ENERGY AND GREEN RETROFITS

Introduction to Green Building and Sustainability

What is green building?

Which definition do you prefer?

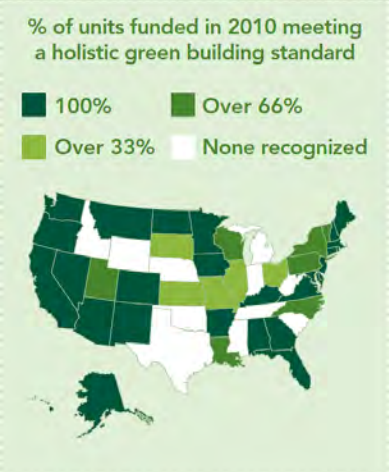
A.) Green building is the practice of creating structures and using processes that are environmentally responsible and resource efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. - EPA

B.) (Green buildings are) high performance, healthful, durable, affordable and environmentally sound buildings. - LEED for Homes

C.) A green building is one that uses energy and materials more effectively both in production and operation while polluting and damaging natural systems as little as possible. - buildingscience.com

GREEN STANDARDS INCREASING

Nationwide, **63%** of units financed with LIHTC in 2010 committed to meet a holistic green building standard.



Courtesy Enterprise

Bellingham, WA Green Communities Initiative

CASE STUDY
Bellingham Green Communities

Owner:
Bellingham Housing Authority

Location:
Bellingham, WA

Completed:
2011

Key concepts:
Resource savings, community building

Photo credit:

Bellingham Green Communities Overview

- **396 units in three 1970s buildings**
  - Envelope and insulation improvements
  - New hot water heating system with solar hot water panels on the roof
  - Photovoltaic electrical panels
  - Energy efficient lighting and lighting controls
  - Improved ventilation
  - Green roof retrofit to existing resident courtyard
  - Rainwater harvesting for landscape irrigation

- **Now performing 17 percent over 2004 building standards**

Bellingham Green Communities Lesson

- Resident education and community participation
- Creative recycling of building waste
- Thirty percent energy savings

CASE STUDY
Curtis Apartments Cogeneration

Owner:
Worcester Housing Authority

Location:
Worcester, MA

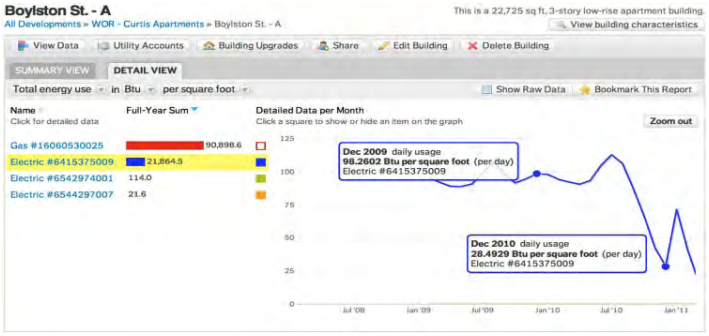
Completed:
2010

Key concepts:
Energy retrofit with cogeneration

Photo credit: Mercantile Square Lofts

Curtis Apartments Cogeneration Overview and Lessons

- Replaced boiler system and installed cogeneration system simultaneously
- Achieved 50 percent energy savings



CASE STUDY ecoMOD

Owner:
University of Virginia

Location:
Nationwide

Founded:
2004

Key concepts:
Research, education and sustainable construction

ecoMOD Overview

Uses pre-fabricated components to create efficient and sustainable dwellings and communities

ecoMOD
new units

ecoREMOD
adaptive additions

ecoMOD XS
small or accessory dwellings

Los Angeles Eco-Village Case Study

Eco-Village

Measures	Cost
Insulation	$9,630
Demand controls for central boiler	$1,816
Dual pane glass doors	$20,645
Total Cost	**$32,091**
Incentives through DfC	**$32,091**
Net Costs	**$0**

Cost Savings	
Electric cost savings/year	$4,700
Gas cost savings/year	$3,900
Total energy efficiency improvement after rehab	30%

In your opinion which is the greenest project?

A.) Bellingham Washington

B.) Curtis Apartments Cogeneration

C.) ecoMOD

D.) Eco - Village

Introduction to Green Building and Sustainability

Green Building:

✓Location efficient
✓Conserves
- energy,
- water,
- materials and
- resources

✓Healthy and accessible
✓Built to last

Introduction to Green Building and Sustainability

What type of project do you anticipate next?

A.) Weatherization

B.) Mod Rehab

C.) Substantial Rehab

D.) New Construction

E.) NA

Introduction to Green Building and Sustainability

- Utility costs in public and assisted housing are more than a quarter of operating costs
- Maintenance is more than a third

Introduction to Green Building and Sustainability

Integrated Design

Whole Building Design Guild - National Institute of Building Sciences

Introduction to Green Building and Sustainability

HUD Spends $7 Billion a Year on Utilities

iRespond

How would you spend $1.4 billion in energy savings?

A.) Tenant services

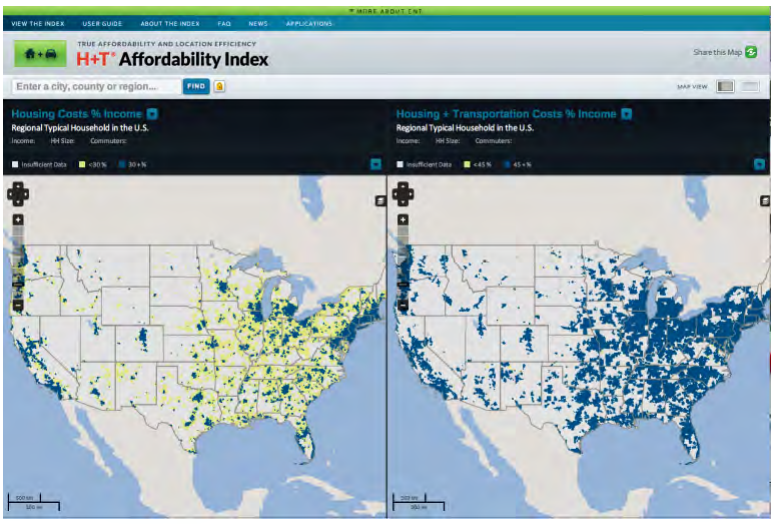
B.) Neighborhood renewal

C.) More housing

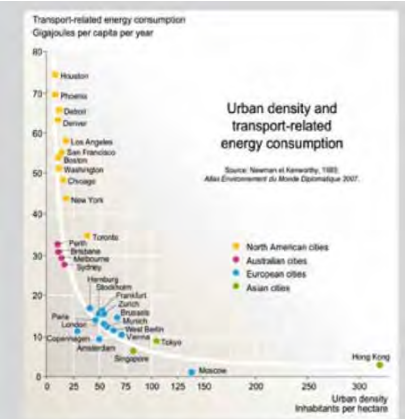
D.) Other

Module 2

Location Efficiency and Site Design



Location Efficiency: Facts and Impact



Source: Newman et Kenworthy, 1989; *Atlas Environnement du Monde Diplomatique 2007.*
UNEP/GRID-Arendal http://www.grida.no/publications/vg/kick/

Location Efficiency: Site Selection

Build here

Not here

iRespond

What are the most important obsticals to securing affordable housing sites?

A.) Zoning

B.) Lag in securing funding

C.) Neighborhood response (NIMBY)

Location Efficiency: Site Design & Management

CASE STUDY
Mercantile Square Lofts

Owner:
Morey Mercantile LLC

Location:
Denver, CO

Completed:
1996

Type:
Mixed-use renovation

Photo credit: Mercantile Square Lofts

Mercantile Square Lofts Goals

- Honor goal of LoDo District to preserve historic character
- Preserve a beloved landmark
- Provide affordable housing amid rising demand
- Add housing units convenient to urban center and transit

Mercantile Square Lofts Overview

- Multi-unit residential above retail
- Historic rehab in urban setting
- 94 residential units, including 77 affordable
- 133,00 square feet, including 52,000 retail and 18,000 office
- LEED Gold certification

Photo credit: Mercantile Square Lofts

Mercantile Square Lofts Financing

- Equity: LIHTC
- Grant: public agency (state historic grant)
- Loans: Public institution (TIF), traditional mortgage
- Bonds: Tax Increment Financing
- Total project cost (land excluded): $20.7 million

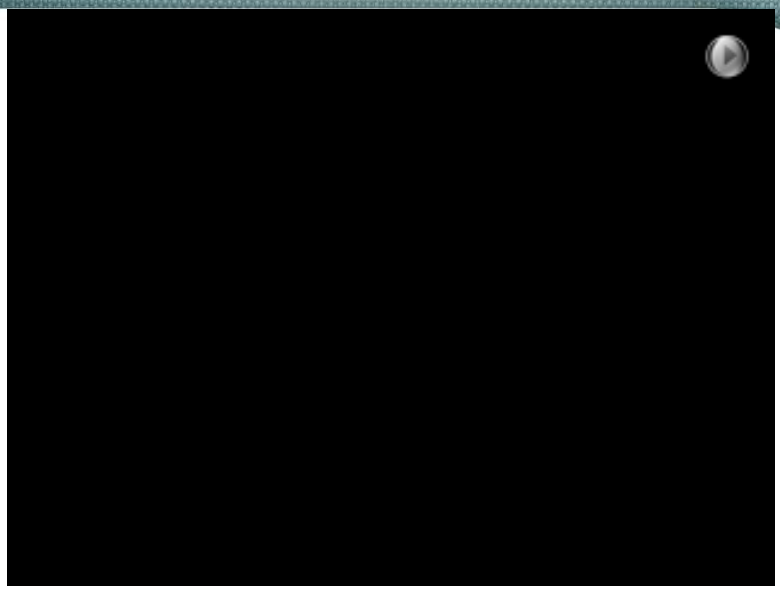
Mercantile Square Lofts Design

Photo credit: Mercantile Square Lofts

Mercantile Square Lofts Lessons

Local partnerships can:

- Create and preserve affordable housing
- Reuse industrial buildings
- Preserve landmarks
- Revitalize whole districts
- Create walkable, transit-oriented neighborhoods



CASE STUDY
South Lincoln Redevelopment Project (SoLi)

Owner:
Denver Housing Authority

Location:
Denver, CO

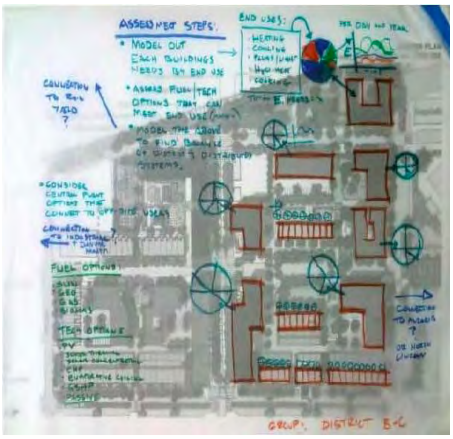
Completed:
1996

Key concept:
Sustainable, integrated redevelopment

Photo credit: Mercantile Square Lofts

South Lincoln Redevelopment Project (SoLi)Overview

- In Denver's La Alma/Lincoln Park neighborhood
- 270 public housing units on 17.5 acres
- Integrated design and construction process



South Lincoln Redevelopment Project (SoLi) Charrettes

- Energy
- Transportation
- Stormwater
- Green Infrastructure

South Lincoln Redevelopment Project (SoLi) Lessons

- Build on existing plans
- Get resident and stakeholder buy-in
- Think beyond the property line
- Create a convening body that promotes interagency communication and collaboration

Green Site Selection

- Location efficiency
- Solar access
- Environmental preservation

Green Site Design

- Solar orientation
- Prevailing winds
- Pedestrian and bicycle access
- Groundwater recharging
- Existing features
- Sustainable planting
- Usable spaces

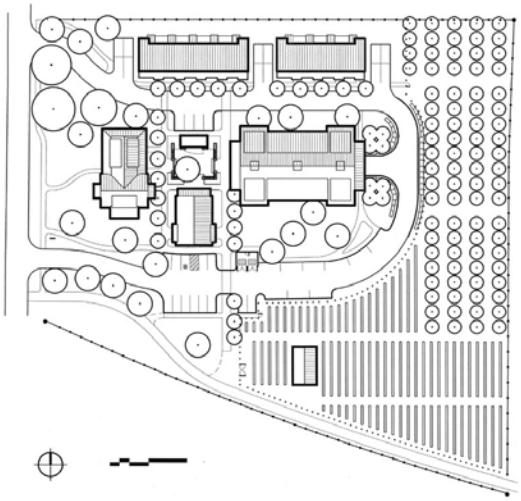
Orchard Gardens

Missoula MT

Developer:
homeWORLD

Architect:
MacArthur, Means & Wells Architects, PC

36 units – 30-50% AMI
7.5 units per acre



Orchard Gardens

Photos: Mark Fritch courtesy the Design Advisor

Pine Ridge Townhomes

Ketchum, ID

Developer: Thunder Springs LLC

Architect: Living Architecture

32 units- mixed inc.
16.6 units per acre

Pine Ridge Townhomes

Photos: Living Architecture courtesy the Design Advisor

Site Design: Eastampton Township, NJ

Original Site Plan

Automobile Intensive

Wide Road Ways

No relationship of buildings to each other

Uses more land

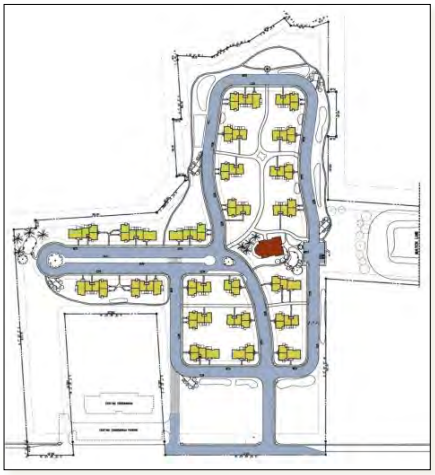
Buildings closer to wetlands

Building orientation doesn't take advantage of passive solar gain

Community building and other services not accessible

Courtesy Pennrose Properties/Kitchen & Associates

Site Design: Eastampton Township, NJ



Modified Site Plan

Compact site plan allowed for nature trail and playing field

Oriented for passive solar gain

Community building centrally located

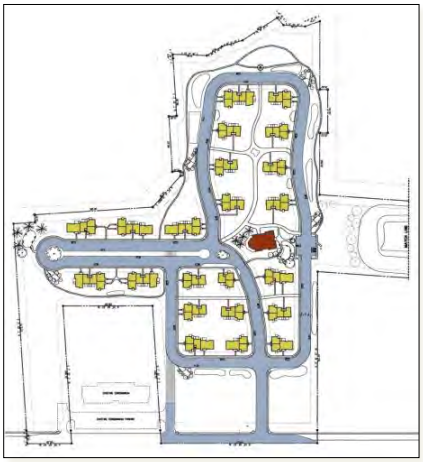
Narrower road widths

Rain Gardens

Housing connected by paths and common spaces - creating sense of community

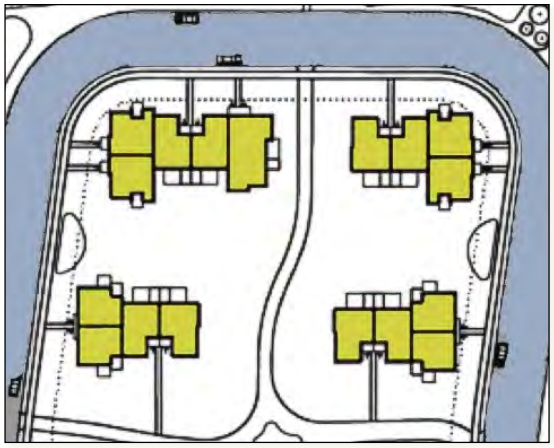
Courtesy Pennrose Properties/Kitchen & Associates

Site Design: Eastampton Township, NJ



Courtesy Pennrose Properties/Kitchen & Associates

Site Design: Eastampton Township, NJ



Courtesy Pennrose Properties/Kitchen & Associates

Module 3

Water Conservation: Facts and Impact

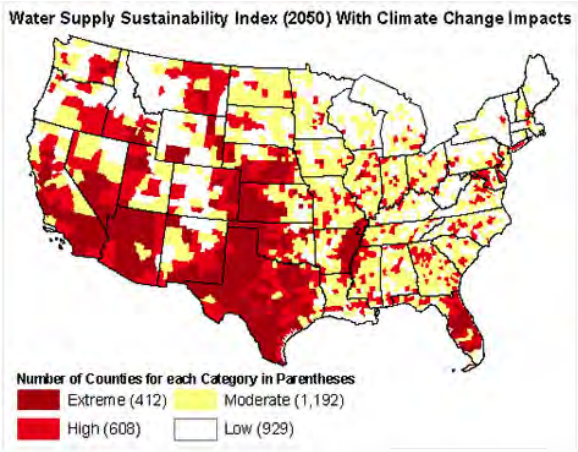


image: NRDC

Water Conservation: Indoor Water Use

Leaking Pump

Enterprise Community Partners

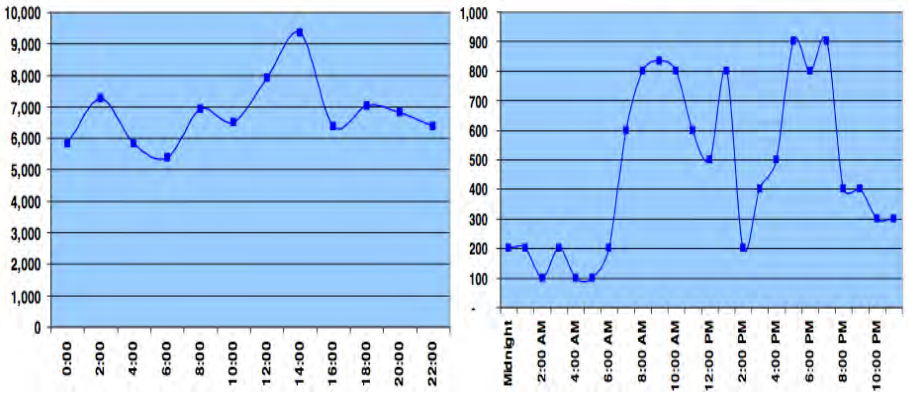
According to the U.S. EPA, if all U.S. households installed water-efficient fixtures and appliances, the country would save more than 3 trillion gallons of water and more than **$18 billion dollars per year.**

Water Conservation: Indoor Water Use

Water Conservation: Stormwater Management

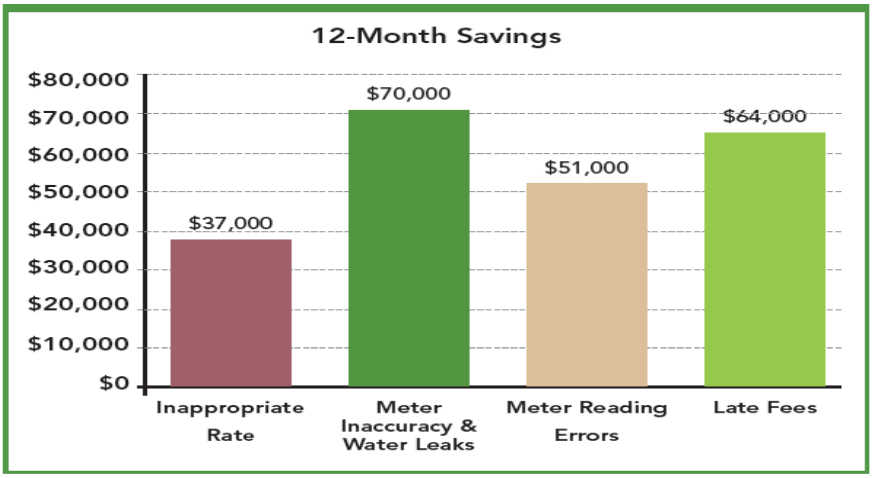
Water Conservation: Irrigation

Water Conservation: Integrative Approach

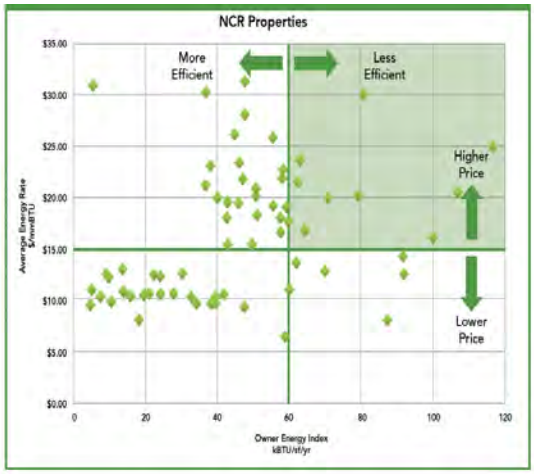


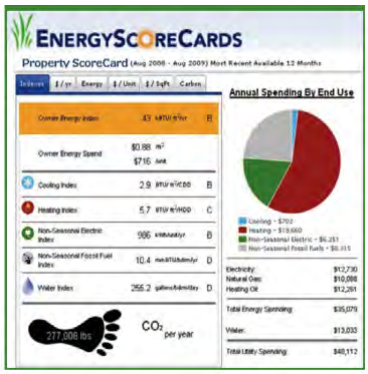
Daily Measured Water Consumption for Two Properties
(In gallons per hour)

Water Conservation: NCR Case Study



Water Conservation: Case Study





Water Conservation: Case Study

	Cost	Annual Savings	Average Payback Period
Lighting retrofit initiative	$1.1M	$300,000	3.6 years
Water conservation initiative	$183,000 per property	$213,000 per property	10 months

CASE STUDY
CMHA Green Roof Installation

Owner:
Cuyahoga Metropolitan Housing Authority

Location:
Cleveland, OH

Completed:
2007

Project type:
Energy retrofit

Photo credit: Cuyahoga Metropolitan Housing Authority

CASE STUDY
Goals

- Reduce storm water runoff
- Reduce roof top temperatures and the "heat island" effect surrounding it
- Reduce heating requirements for the building
- Add visible value

Photo credit: Cuyahoga Metropolitan Housing Authority

CASE STUDY
Overview

- Installed in 2007, matured in approximately two years
- Now covering 8,750 square feet on seven buildings at Lakeview Terrace
- Modification of traditional, existing roof system

Photo credit: Cuyahoga Metropolitan Housing Authority

CASE STUDY
Financing

Financed through
- HUD Energy Performance Contracting (EPC) Program

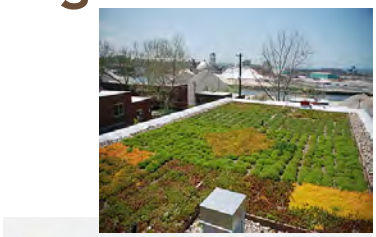


Photo credit: Cuyahoga Metropolitan Housing Authority

CASE STUDY
Lessons

- Green roof construction can be part of on overall energy reduction strategy
- Pilot installation can help test a strategy for future implementation
- Energy and Green upgrades can provide job training and opportunity to build resident skills
- Green roofs have community benefits beyond savings

Photo credit: Cuyahoga Metropolitan Housing Authority

Water Conservation: Synthesis

1. Indoor
2. Outdoor

Photo: Kathleen Dorgan

Module 4

Resident Health, Safety, and Accessibility: Facts and Impact

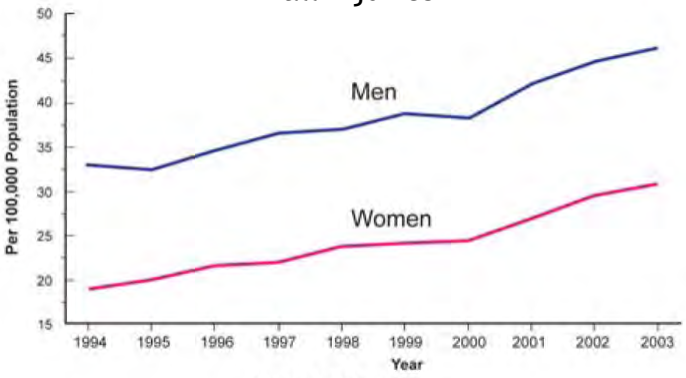
Sources of air pollution are in homes, schools, and offices. Some pollutants cause health problems such as sore eyes, burning in the nose and throat, headaches, or fatigue.

Other pollutants cause or worsen allergies, respiratory illnesses (such as asthma), heart disease, cancer, and other serious long-term conditions.

Sometimes individual pollutants at high concentrations, such as carbon monoxide, cause death.

Resident Health and Safety: Facts and Impact

Fall Injuries



Source: CDC, 2006c

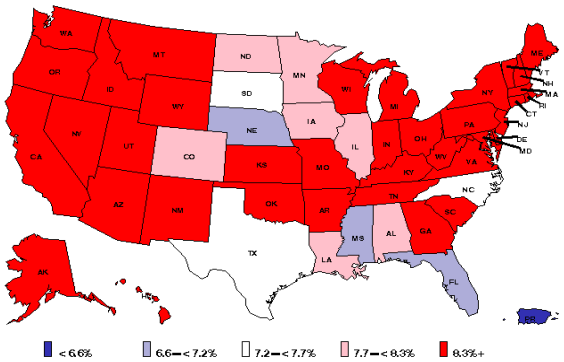
Resident Health and Safety: Facts and Impact

Fall injuries: curb cut summer (left) and winter (center and right)

Source Toronto Rehabilitation Institute

Asthma National Perspective

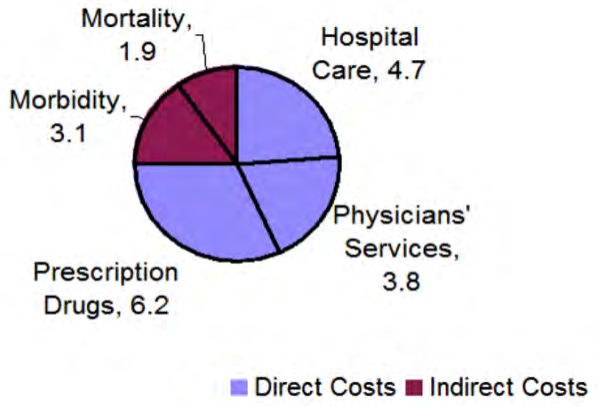
Map C1
Adult Self—Reported Current Asthma
Prevalence Rate (Percent) by State, BRFSS 2008



Footnote: Ranges are based on quintiles of the overall prevalence estimates from year 2000 data.

Air Pollution and Respiratory Health Branch, National Center for Environmental Health
Centers for Disease Control and Prevention

Resident Health and Safety: Facts and Impact



$19.7 Billion Asthma Cost in US 2007, NIH, 2007

Housing-based Asthma Triggers

Moisture

Tobacco Smoke

Dust Mite

Cockroach Feces

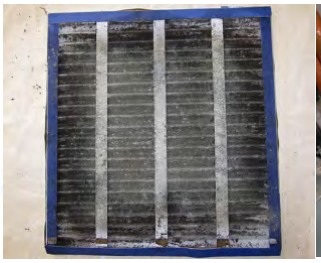
Pest: Cockroach

Pest: Mice Feces

Courtesy New Ecology, INC

Resident Health and Safety: Facts and Impact

HEALTHYHOMES
Healthy Families | Healthy Children



The EPA ranks indoor air pollution among the top five environmental risks to public health.

MERV Filtration

16	> 95	> 95	> 95	–	**0.3–1 µm** All bacteria Droplet nuclei (sneeze) Cooking oil Most smoke Insecticide dust Most face powder Most paint pigments	Superior commercial buildings Hospital inpatient care General surgery	**Bag Filters** – Non supported (flexible) microfine fiberglass or synthetic media, 12 to 36 inches deep. **Box filters** – Rigid style cartridge, 6 to 12 inches deep.
15	85–95	> 90	> 90	> 95			
14	75–85	> 90	> 90	90–95			
13	< 75	> 90	> 90	80–90			
12	–	> 80	> 90	70–75	**1–3 µm** Legionella Humidifier dust Lead dust Milled Flour Auto emission particles Nebulizer drops	Superior residential Better commercial buildings Hospital laboratories	**Pleated filters** – Extended surface with cotton or polyester media or both, 1 to 6 inches thick. **Box Filters** – Rigid style cartridge, 6 to 12 inches deep.
11	–	65–80	> 85	60–65			
10	–	50–65	> 85	50–55			
9	–	< 50	> 85	40–45			
8	–	–	> 70	30–35	**3–10 µm** Mold Spores Dust mite body parts and droppings	Better residential Commercial buildings Industrial workspaces	**Pleated filters** – Extended surface with cotton or polyester media or both, 1 to 6 inches thick
7	–	–	50–70	25–30			

HEPA – 99.97% plus

Resident Health and Safety: Healthy Building Materials

Resident Health and Safety: Indoor Air Quality

Water Vapor	Bulk Moisture	Condensation
▪ Showers ▪ Cooking ▪ Humidifiers ▪ Evaporated Bulk Moisture	▪ Standing water ▪ Roof Leaks ▪ Plumbing Leaks ▪ Ice Dams	▪ Exposed Ductwork ▪ Windows ▪ Condensed Water Vapor *(Water vapor condenses when it comes in contact with a surface below the dew point)*

Moisture is the #1 cause of structural failure

Resident Health and Safety: Indoor Air Quality

Proper ventilation is vital for:
- Moisture control
- Indoor Air Quality
- Combustion Appliances
- Comfort

Resident Health and Safety: Integrated Pest Management

QualityPro Green
GreenShield
EcoWise

Resident Health and Safety: Integrated Pest Management

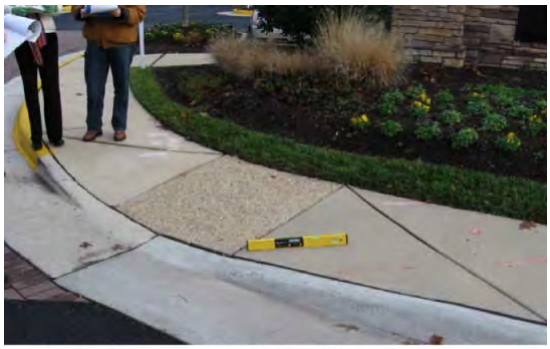
- Property Managers should use IPM methods
- Reduce food, water that attracts them.
- Use baits & gel, **NOT sprays**
  - Won't work if contaminated by strong-smelling cleaners or other chemicals, pesticide sprays or foggers or nicotine from cigarette smoke.
  - Use in every room.
- Tenants are key partners.

Gel Bait

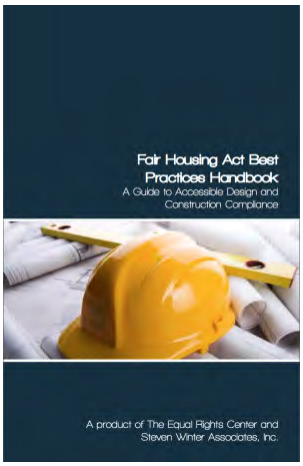
Bait Station

Resident Health and Safety: Integrated Pest Management

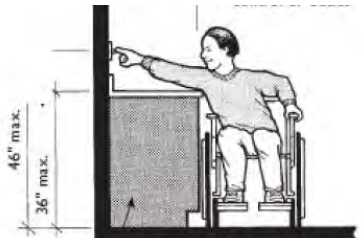
Resident Health and Safety: Accessibility



Common Compliance Oversight:
Curb Ramp Creates Excessive Cross Slope



Accessibility

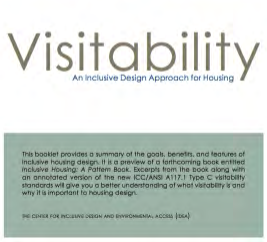


ADA – All public spaces

Section 504 - Apartments

Resident Health and Safety: Accessibility – Visitability

- At least one zero-step entrance approached by an accessible route on a firm surface no steeper than 1:12, proceeding from a driveway or public sidewalk
- Wide passage doors
- At least a half bath/powder room on the main floor



Resident Health and Safety: Accessibility – Visitability


On flat lots...


and steep lots.


In high-end houses...


Detached houses...


and town houses.

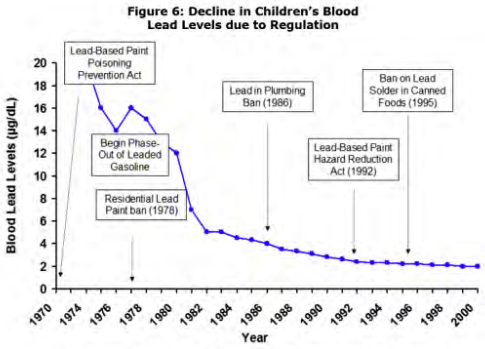

and inexpensive houses

Photo Crediit: concrete change.org

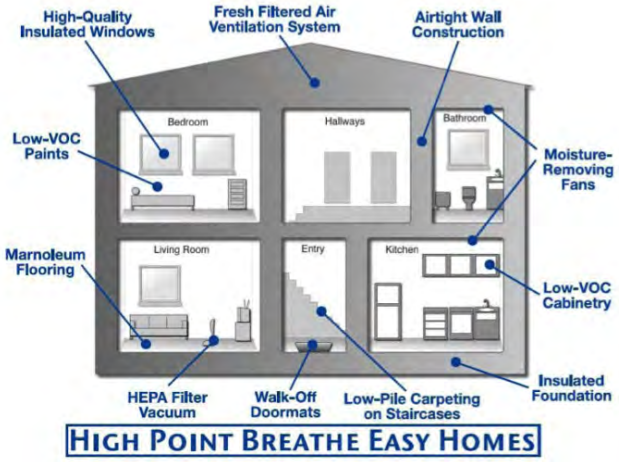
Resident Health and Safety: Integrative Approach

Increased collaboration has decreased:

- Second hand smoke
- Unintentional Injuries
- National Disasters
- Lead Hazards
- Radon Risk



Resident Health and Safety: Case Study



Resident Health, Safety, and Accessibility: Synthesis

Module 5

Materials and Resources

CASE STUDY
Wheeler Terrace

Owner:
Community Preservation and Development Corp

Location:
Washington, DC

Completed:
April 2012

Type:
Deep Renovation

Photo credit: Enterprise

Wheeler Terrace Goals

- Saving affordable apartments that are near transit along with recreational, cultural and medical resources, while reusing older buildings
- Saving energy, resources and money over the long term through Green retrofit
- Improving health measurably by improving indoor air quality

Photo credit: DCMud Blog

- Revitalizing the site and connecting it with the larger urban area

Wheeler Terrace Strategies

- Formed tenant association and purchased property
- Assigned rights to CPDC
- Re-secured Section 8 status

Photo credit: National Center for Healthy Housing

Wheeler Terrace Overview

- 116 total units
- 133,000 SF
- Urban setting
- LEED Gold

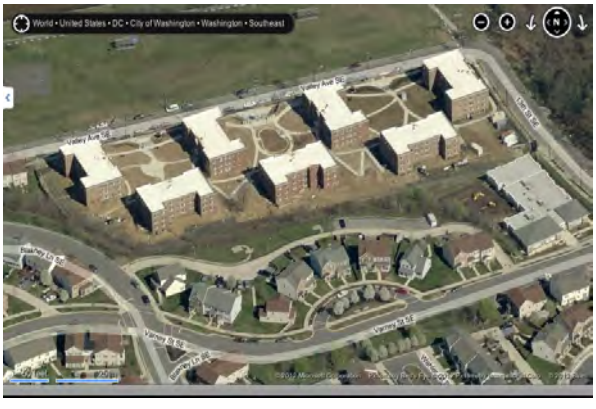


Photo credit: Bing Maps

Wheeler Terrace Financing

Equity: LIHTC

Grant: Private (foundation), public agency (ARRA)

Loans: Public institution

Total project cost (land excluded): $32,000,000, ($131,000 per unit)

Wheeler Terrace Design Elements

- Walls insulated and windows replaced
- New roof coating and one green roof
- Low-volatile finishes, sealants, adhesives and carpets
- Geothermal heat pump
- Energy STAR appliances and lighting
- Stormwater sand filter system

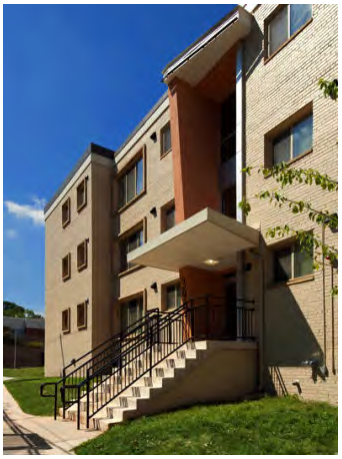


Photo credit: Enterprise

Wheeler Terrace Indoor Environment

Photo credit: DCMud Blog

Wheeler Terrace Lessons

- Derelict properties can be turned around with strategic partnerships and green design strategies
- Indoor air quality, a tenant priority, can become a measurable goal
- Making tenants a partner in the development helps them take ownership of the changes

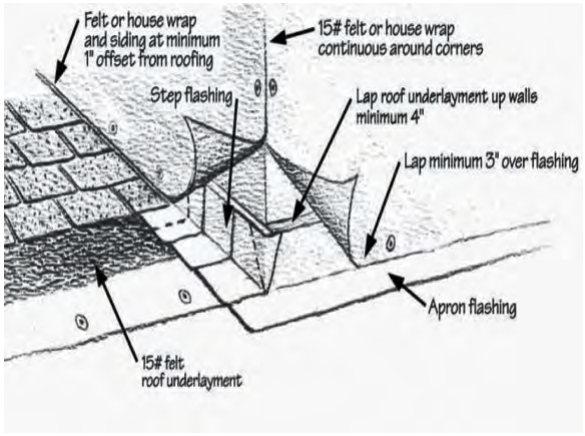
Materials and Resources: Reuse & Waste Reduction

Photo: Kathleen Dorgan

Materials and Resources: Durability

Standing against

- Moisture
- Sunlight (UV radiation)
- Temperature
- Chemicals
- Insects
- Fungi
- Natural Hazards
- Wear and Tear



Materials and Resources: General Cond. & Certifications

Energy Efficiency: HUD New Construction

look for WaterSense Meets EPA Criteria

ENERGY STAR

FEMP
FEDERAL ENERGY MANAGEMENT PROGRAM

ENERGY STAR Buildings

ENERGY STAR Buildings Feature…

Effective Insulation

Properly Sized Equipment

Tight Construction and Ducts

3rd Party Tested and Verified

ENERGY STAR Lighting

ENERGY STAR Appliances

High Performance Windows

EPA

Materials and Resources: Integrative Approach

KADorgan

Materials and Resources: Case Study

CASE STUDY
Housing Nantucket

Owner:
Housing Nantucket

Location:
Nantucket, MA

Started:
1994

Program:
Recycling structures

Photo credit: Housing Nantucket

Housing Nantucket
Goals and Achievements

- Founded in 1994 to retain residents who would otherwise have to leave.
- Moved unwanted homes to new sites and created 26 rental units.
- Available to those earning 50-100 percent of median

Photo credit: Housing Nantucket

Housing Nantucket Organization and Financing

- Two paid staff and an annual budget of $600,000
- Projects funded from fees and from private and public granting sources

Photo credit: Housing Nantucket

Housing Nantucket Operations

Photo credit: Housing Nantucket

Housing Nantucket acquires vacant sites from the Nantucket Housing Authority and the Town of Nantucket

Housing Nantucket Operations

Photo credit: Housing Nantucket

A rehabbed house awaits its new tenant.

Housing Nantucket Lessons

- Unwanted but sound houses can be reused on vacant lots, preserving community character and fabric
- Historic housing can be made into a vital part of the affordable housing supply and the future of the community

Synthesis

Green Building Issues covered this morning:

- Location
- Site Planning
- Water Conservation and control
- Health and Safety
- Accessibility
- Materials and Resources

Module 6

Energy Efficiency

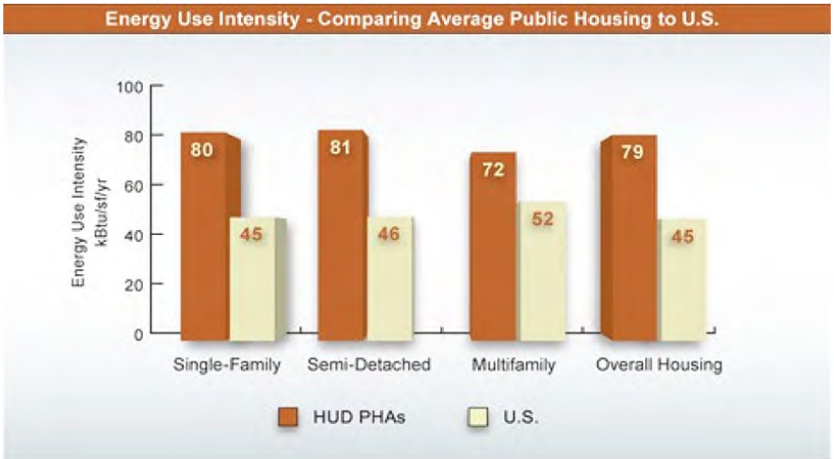
Energy Efficiency

Continuous Drainage Plane, Air Barrier and Insulation

Properly-sized HVAC System

Properly-installed HVAC System

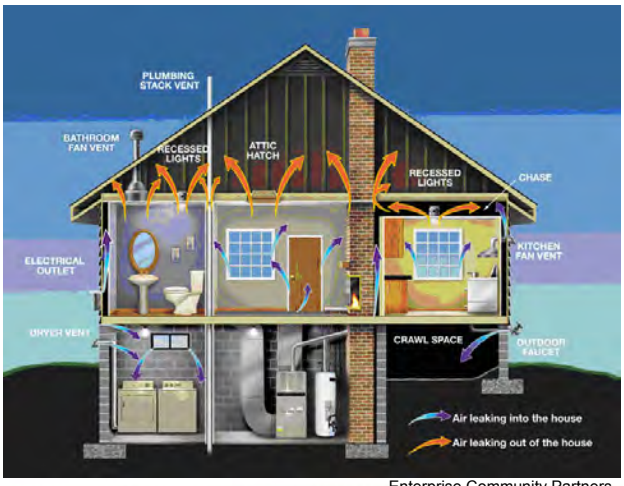
Energy Efficiency: Facts and Impacts



Energy Efficiency: Analyzing Existing Conditions

Enterprise Community Partners

Energy Efficiency: Analyzing Existing Conditions



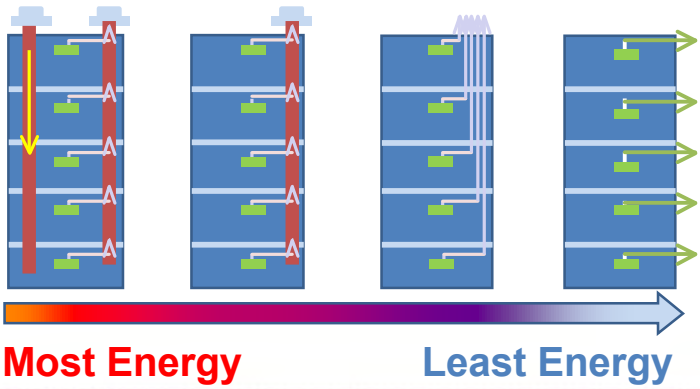
Enterprise Community Partners

- Air movement in and out of conditioned spaces
- Stack and wind effects, shafts & by-passes
- Exhaust & supply fans

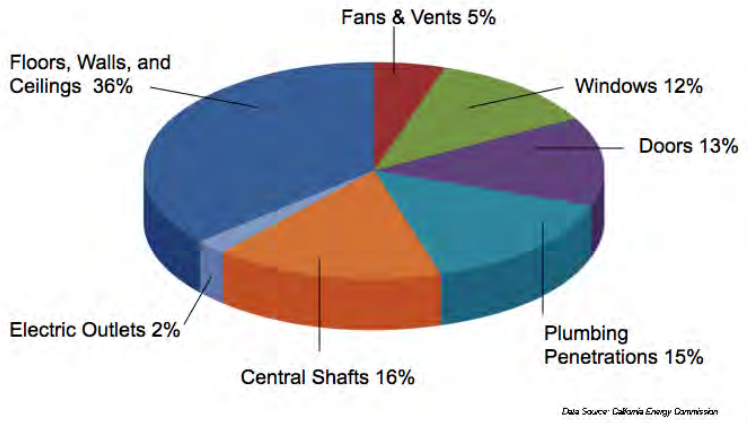
Energy Efficiency: Analyzing Existing Conditions

Multifamily Billing Analysis: New Mid-Rise Buildings

City of Seatte Research Consultant: Ecotope w/ GGLO

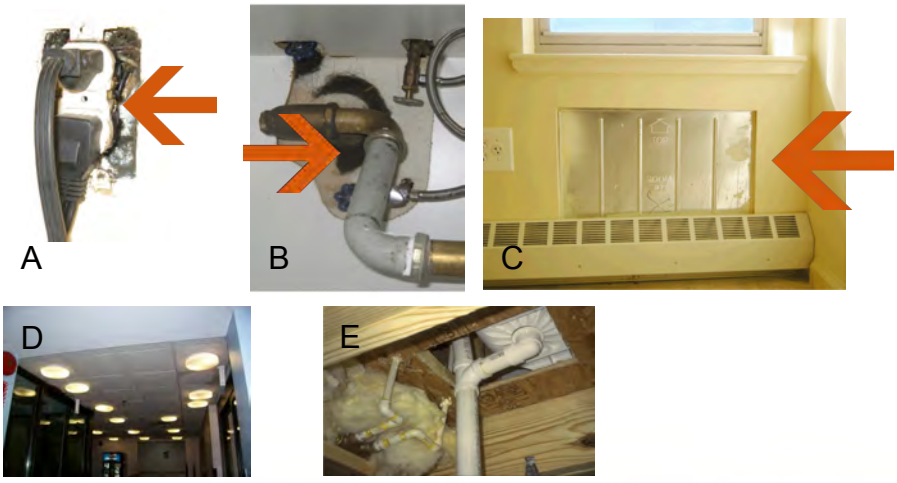


Energy Efficiency



Building air leakage in residential properties

Energy Efficiency: Analyzing Existing Conditions



Energy Efficiency: Analyzing Existing Conditions

- ENERGY AUDIT
- Research
- Energy and Water Data
- Review of operations
- Physical Inspection
- Analysis
- Recommendations

Energy Efficiency: Analyzing Existing Conditions

Audit Recommendations:

- Energy Conservation Measures
- Integrated Pest Management
- Property repairs
- Other

Replace or maintain equipment

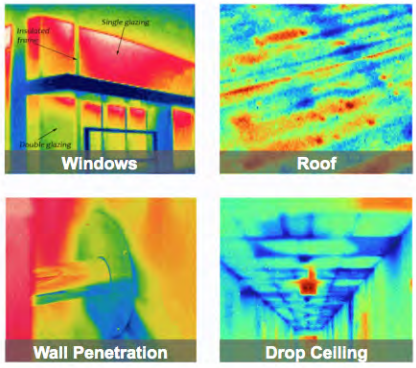
Energy Efficiency: Analyzing Existing Conditions

AUDIT STANDARDS:

- RESNET
- BPI
- ASHRAE
- Local

Sources of Heat Loss (and Gain)

- Non-insulated roof
- Broken windows
- Single-pane windows
- Poor air-sealing



Enterprise Green Communities

Energy Efficiency: Analyzing Existing Conditions

AUDIT TYPES –MOST to least EXTENSIVE

- *Investment Grade Audit*
- *Whole building audit*
- *Weatherization audit*
- *Walkthrough audit*

Enterprise Green Communities

Energy Efficiency: Analyzing Existing Conditions

Exterior view of house fronts framing corner of new residential square.
Credit: Alain Jaramillo, Photographer

Interior view of living room, with Count Rumford fireplace to right.
Credit: Dick Francis- fotosWest

Energy Efficiency: Upgrade and Rehab Guidelines

Energy Efficiency: RESNET HERS Index

A verified rating of energy efficiency on a scale, where 0 is Net Zero Energy and 100 is the typical new home.

Energy Efficiency: Verification & Testing

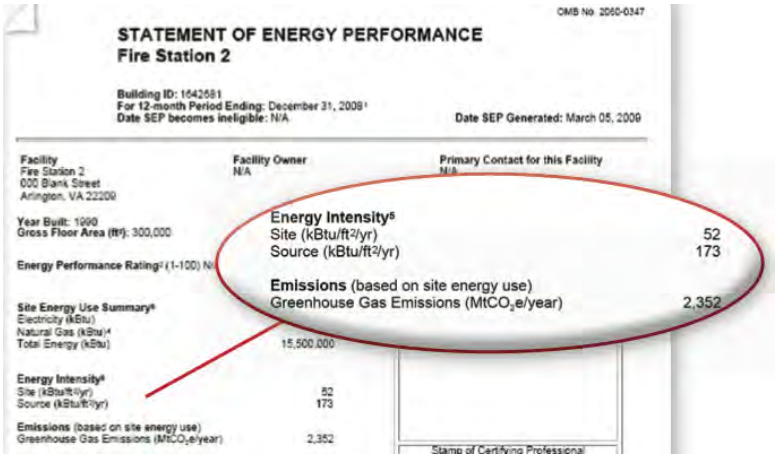
How successful

is

the green building project???

Blower Door Test

Energy Efficiency: Analyzing Existing Conditions



OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Fire Station 2

Building ID: 1642581
For 12-month Period Ending: December 31, 2008[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: March 05, 2009

Facility
Fire Station 2
000 Blank Street
Arlington, VA 22209

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1990
Gross Floor Area (ft²): 300,000

Energy Performance Rating[2] (1-100) N/

Site Energy Use Summary[3]
Electricity (kBtu)
Natural Gas (kBtu)[4]
Total Energy (kBtu)
15,500,000

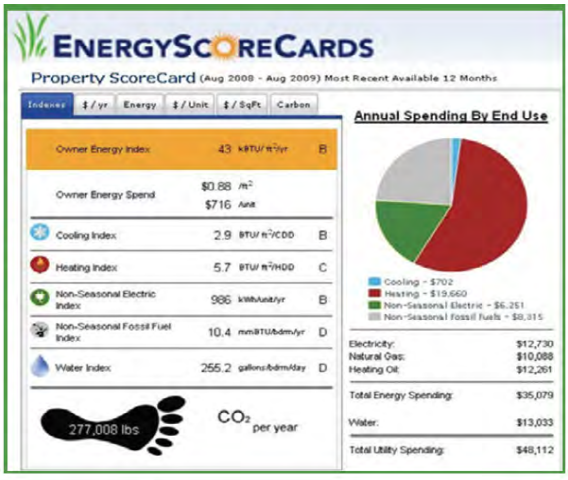
Energy Intensity[5]
Site (kBtu/ft²/yr) 52
Source (kBtu/ft²/yr) 173

Emissions (based on site energy use)
Greenhouse Gas Emissions ($MtCO_2e$/year) 2,352

Stamp of Certifying Professional

EPA Portfolio Manager

Energy Efficiency: Analyzing Existing Conditions



ENERGYSCORECARDS

Property ScoreCard (Aug 2008 - Aug 2009) Most Recent Available 12 Months

Indexes | $ / yr | Energy | $ / Unit | $ / SqFt | Carbon

Owner Energy Index	43 kBTU/ft²/yr	B
Owner Energy Spend	$0.88 /ft² $716 /unit	
Cooling Index	2.9 BTU/ft²/CDD	B
Heating Index	5.7 BTU/ft²/HDD	C
Non-Seasonal Electric Index	986 kWh/unit/yr	B
Non-Seasonal Fossil Fuel Index	10.4 mmBTU/bdm/yr	D
Water Index	255.2 gallons/bdm/day	D

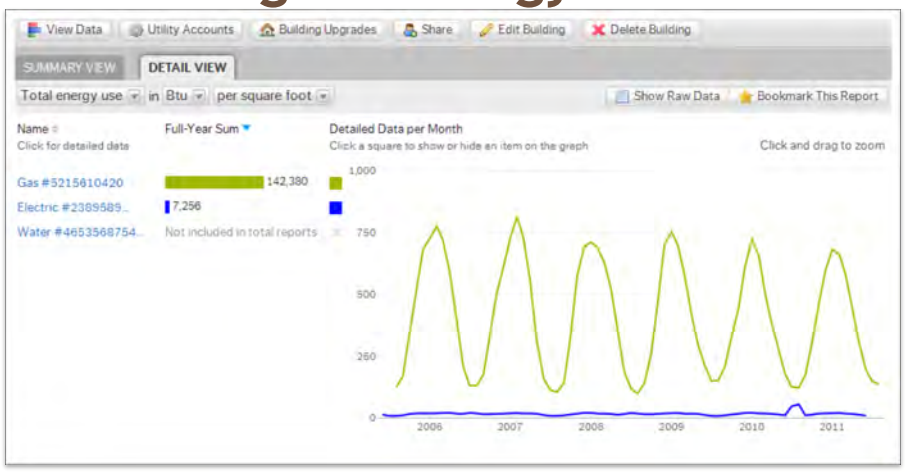
277,008 lbs CO_2 per year

Annual Spending By End Use

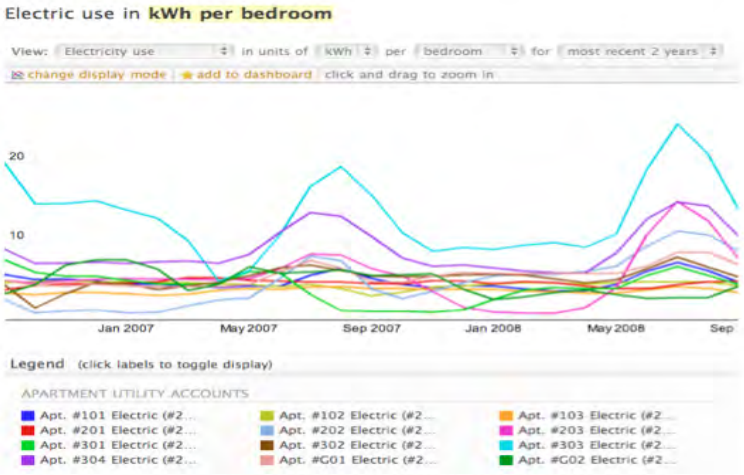
Cooling - $702
Heating - $19,660
Non-Seasonal Electric - $6,251
Non-Seasonal fossil fuels - $8,315

Electricity:	$12,730
Natural Gas:	$10,088
Heating Oil:	$12,261
Total Energy Spending:	$35,079
Water:	$13,033
Total Utility Spending:	$48,112

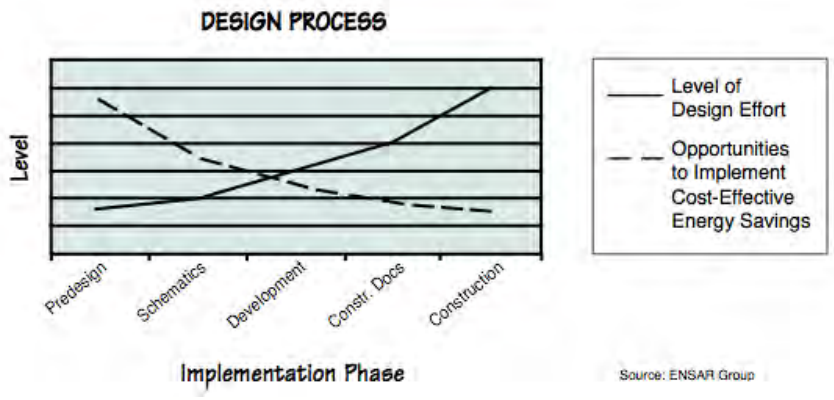
Energy Efficiency: Gas is the Largest Energy User



Energy Efficiency: Analyzing Existing Conditions



Energy Efficiency: Integrative Approach



Source: NREL

Module 7

Operations & Maintenance: Facts and Impact

Several studies over the past few years have indicated that existing U.S. commercial office buildings hold tremendous opportunities for increasing energy efficiency through low-cost O&M improvements.

These improvements can yield savings of five to twenty percent of a building's annual utility bill. Simple paybacks are generally less than 2 years, which equals a 98% IRR (based on a 7 year measure life.)

PECI

Operations & Maintenance: Training

Building Performance Institute, Inc.

LEED for Homes Green Rater Candidate Handbook

Updated July 2012

Healthy Homes Specialist

CASE STUDY
Paisano Senior Housing

Owner:
HACEP

Location:
El Paso, TX

Completed:
2012

Program:
Net Zero Energy

Photo credit: Workshop8

Paisano Senior Housing Goals

- Site reuse
- Net zero energy
- High quality living environment
- Visitable
- Highest design quality

Paisano Senior Housing Overview

- Reuse of existing site
- 14 structures united by common wall and garden
- 1 and 2 bedrooms plus SROs
- All wheelchair adaptable

Paisano Senior Housing Financing

- Total project cost: $10 million
- Financing:
  - $8.25 million from ARRA initiative
  - $1.6 million from Housing Authority of El Paso
  - $.5 million El Paso city loan
  - Donations: Local residents and building owners

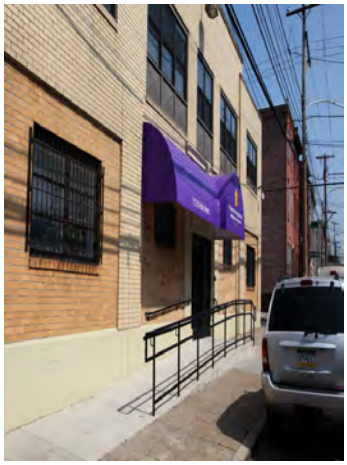
Paisano Senior Housing Features

- Tall canopy wall shelters west side
- Wind turbines
- Rooftop solar panels
- Solar chimneys
- Rooftop gardens

Paisano Senior Housing Lessons

- Overall design excellence goes hand in hand with the highest goals of energy conservation
- With strong partnerships at the local and national levels, it is possible to reach net zero energy use
- In accommodating disabilities, ‘visitability’ is an important value

Operations & Maintenance: Recycling



PHA Administrative Offices

- Administrative Offices
- Appliances
- Deconstruction
- Revenue Generating Opportunities

Operations & Maintenance: Healthy Homes Rating System

CASE STUDIES
Green Cleaning Policy

There are several examples of organizations integrating green cleaning policies into their housing communities.

CASE STUDY
Sherwood Village Senior Apts.

Photo credit: CHISPA

- Salinas, CA
- An innovative composting and recycling program
- Includes YouTube instructional videos on recycling and composting
- Approximately 9 tons of material is recycled annually

CASE STUDY
HELP USA

Photo credit: HELP USA

- Housing for veterans and formerly homeless
- Program of "green lifestyles" for residents

Enterprise Community - Training In A box (TIAB)

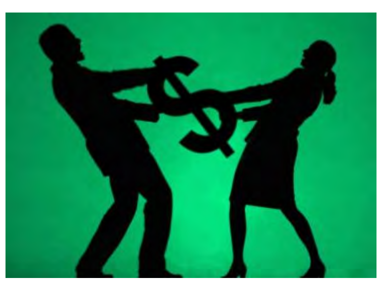
- Four workshops, 30 min each
- Healthy Living module focuses on cleaning

Enterprise Community - Training In A box (TIAB)

TABLE OF CONTENTS

Green Physical Needs Assessment (GPNA)

A projection of future needs and costs based on a condition and operations assessment that includes an Energy Audit

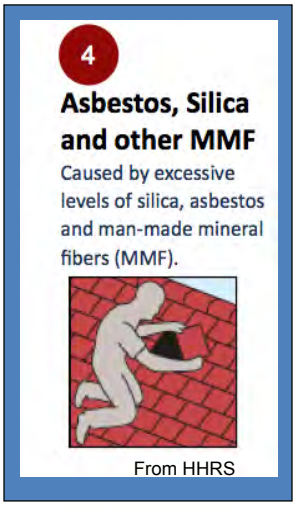


Green Physical Needs Assessment (GPNA)

Includes:

- Assessment of property conditions and identification of necessary repairs and replacements
- Operating cost analysis and projections
- Energy Audit findings including potential savings through energy and water efficiency measures
- Integrated Pest Management Plan

Synthesis

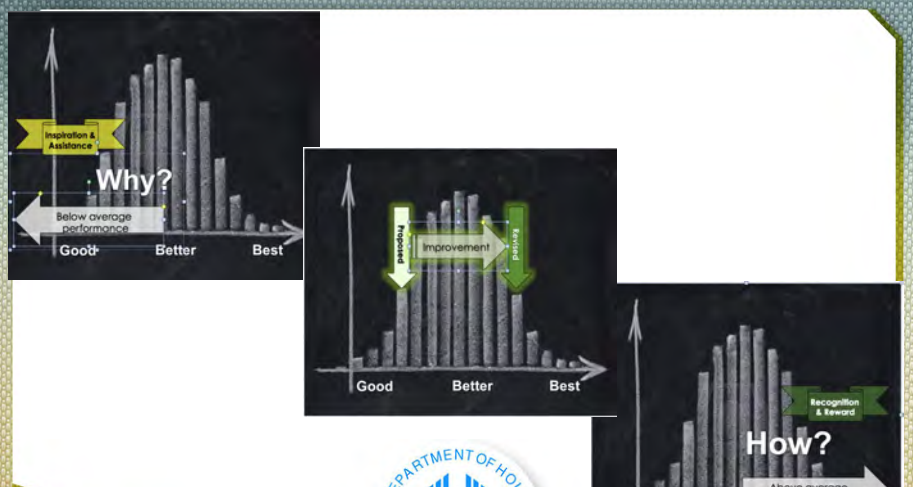


What are the challenges of integrating:

- IPM, recycling, and composting?
- Energy efficiency and indoor air quality?

Module 8

Green Building Standards & Codes: Facts and Impact



Energy Efficiency Codes

2012 IECC:

•15% more Energy Efficient than 2009
•30% more Energy Efficient than 2006

Adopted locally with State variations.

Some States and localities use Other codes

"Above Code" Programs

ENERGY STAR

SOCIAL ECONOMIC ENVIRONMENTAL DESIGN

Enterprise green communities

LEED FOR HOMES

ENERGY STAR

Core Energy Efficiency Features

Complete Thermal Enclosure System	High-quality insulation & fenestration Proper installation & air sealing Reduced thermal bridging
Complete Heating & Cooling System	Fully-engineered design Best practice installation Fresh air & exhaust
Complete Water Management System*	Water-managed site, foundation, walls, and roof *Not required for MFHR

ENERGY STAR

ENERGY STAR® QUALIFIED HOMES
THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

SECTION 3. FULLY ALLIGNED AIR BARRIERS [6]

3.1 Walls[10]
3.1.9 All other exterior walls

Electrical box not air sealed.

B

Wiring penetrations properly air sealed.

ENERGY STAR

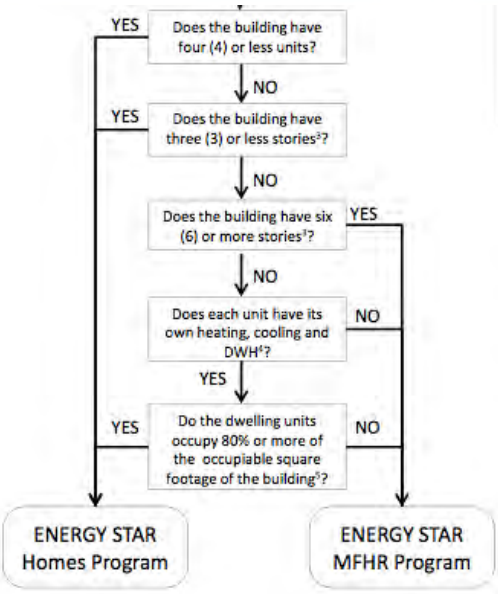
Residential Programs apply to:

- Single Family Homes (detached and attached)
- Factory Built Homes (manufactured and modular)
- Low Rise Residential Buildings

Certified Homes

- Mid and High Rise Residential Buildings*

MFHR



ENERGY STAR Certified Home

Each ENERGY STAR certified home is independently verified to be at least **15%** more energy efficient than a home built to the 2009 International Energy Conservation Code (IECC), and includes additional measures that deliver a total energy efficiency improvement of up to **30%** compared to a typical new home.

ENERGY STAR Certified Homes Raters

- Builders must work with a Home Energy Rater to gain the ENERGY STAR certification.
- Raters provide:
  - Third party verification
  - Quality assurance
- Raters are trained to:
  - Evaluate construction techniques
  - Take key measurements
  - Perform inspections

ENERGY STAR Certified Homes

1. Check eligibility.
2. Check Benchmark Home Size.
3. Select Version 3 energy efficiency measures.

Prescriptive Path

1. Build the home using the ENERGY STAR Reference Design.
2. Complete the inspection checklists.

Performance Path

1. Model the home and find the ENERGY STAR HERS Index Target.
2. Select upgrades that achieve a HERS Index ≤ ENERGY STAR HERS Index Target and meet other program requirements.
3. Complete the inspection checklists.

ENERGY STAR Contractor Certification

Energy Star v3

Builders - ENERGY STAR Orientation

HVAC Contractor - ACCA's Quality Assured Contractor Program or Advanced Energy's Quality-Assured Professional Program

ENERGY STAR
Multi Family High Rise

Each ENERGY STAR certified mid and high rise project is verified to be at least **15%** more energy efficient than a building built to the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2007.

ENERGY STAR MFHR Verifiers

•Developers must work with a Licensed Professional to gain the ENERGY STAR certification.

•Licensed Professionals are Registered Architects or Professional Engineers who:

- Oversee a team of verification providers (e.g. Rater, HVAC Contractor, Test and Balance Engineer)
- Quality assurance
- Fulfill program reporting requirements (Stamped and Signed)

ENERGY STAR MFHR

1. Check eligibility.
2. Select ES MFHR energy efficiency measures.

Prescriptive Path

1. Design the building using the ENERGY STAR MFHR Prescriptive Path.
2. Submit Proposed Design Submittal
3. Complete the T&V protocols and checklists through construction
4. Submit As-Built Submittal

Performance Path

1. Model the building per ASHRAE 90.1 Appendix G and ES Simulation Guidelines
2. Select upgrades that achieve a Performance Target of ≥ 15% and meet other program Prerequisites.
3. Submit Proposed Design Submittal
4. Complete the T&V protocols and checklists through construction
5. Submit As-Built Submittal

ENERGY STAR MFHR

ENERGY STAR Multifamily High Rise Project Application, Version 1.0

- Partnership Agreement wi Energy Star
- Application
- Calculation
- Verification
- Benchmarking – 2 years

EPA Indoor airPLUS

HERS Raters Review of:
- Moisture Control
- Radon Control
- Pest Barriers
- HVAC System
- Combustion Pollutant Control
- Low Emission Materials
- Home Commissioning

"Above Code" Programs

Leadership in Energy and Environmental Design (LEED). Guidelines set by US Green Building Council (USGBC) to attain and independently verify improved performance in areas of sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality.

Courtesy PSL Integrated Solutions

Enterprise Green Communities

Integrative Design

Site Improvements

Water Conservation

Energy Efficiency

Location + Neighborhood Fabric

Healthy Living Environments

Materials Beneficial to the Environment

Operations + Maintenance

2011 Enterprise Green Communities Criteria

Enterprise green communities

LEED

- **LEED for Homes**
  - **Multi-family mid-rise**
  - **REGREEN Residential**
- **LEED-EB:O&M**
- **LEED-ND**

LEED™ FOR HOMES

Healthy Homes Rating System

Scores hazards:

- Physiological
- Psychological
- Infection
- Safety

Passive House

Includes:

PHIUS
Passive House Institute US

•Airtight shell

≤ 0.6 ACH @ 50 pascal pressure

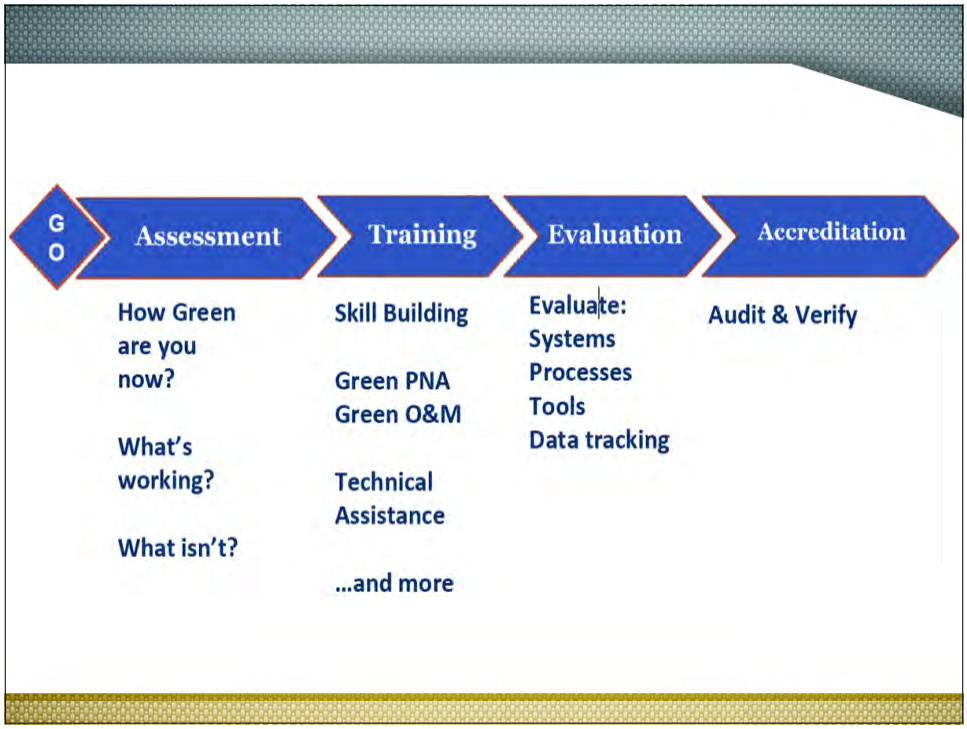
•Low heating requirement

≤ 15 kWh/m2/year (4.75 kBtu/sf/yr)

Green Building Standards & Codes

Module 9

Organizational Sustainability:
Internal Assessment and HUD Accreditation



Organizational Sustainability

Internal Assessment & HUD Accreditation

Organizational Sustainability

Sustainability Policy

- Energy and Water Efficiency
- Employee Health, Training and Productivity
- Recycling and Purchasing
- Resident Training
- Connection to Local Sustainability Plan

Resource: Enterprise Resident Engagement Training in a Box

CASE STUDY
Eden Housing

Founded:
1968

Location:
Alameda County, CA

Example:
Sustainable Organization

Photo credit: Eden Housing

Overview
Eden Housing

- 230 staff members
- $10.2 million budget
- 6,400 affordable housing units in 88 properties

Eden Housing
Goals

- Embarked on three-year program to make the organization sustainable
- New construction exceeds stringent state standards by 15 percent

Photo credit: Eden Housing

Eden Housing
Sustainable Leadership

- Digital Connectors
- Think Green program
- Podcast and resident training

Photo credit: Eden Housing

Eden Housing
Lessons

- It is possible to make a commitment to green in all parts of an affordable housing organization.
- Build success and commitment beginning with small steps and education.
- Incorporate over time for entire portfolio, and measure results.
- Involve young residents in leadership through media training and technology.

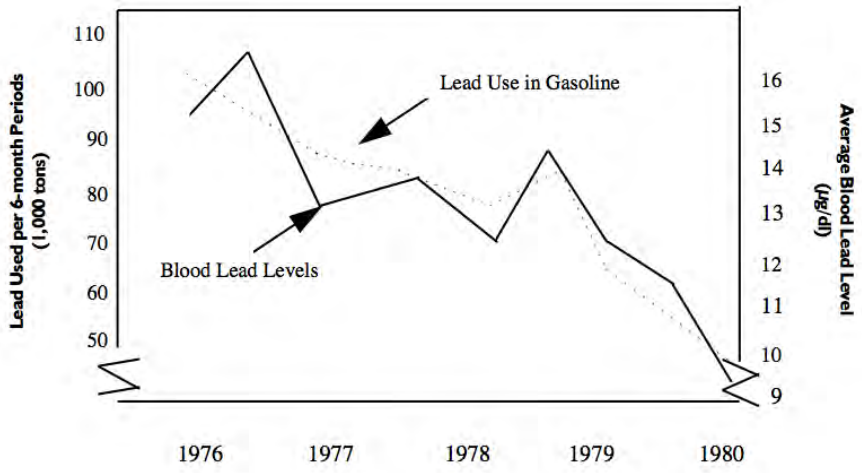
Organizational Sustainability

Review

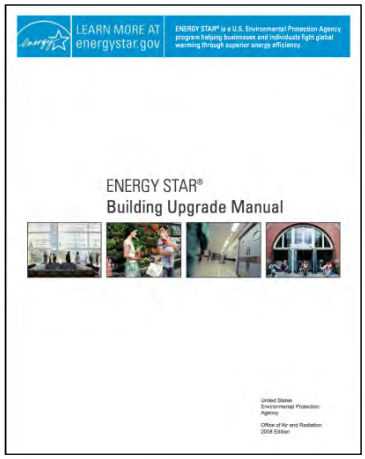
Module 10

HUD Requirements and
Green Building Standards

Facts and Impacts



Green Building Standards and Codes



ENERGY STAR appliances

WaterSense Fixtures

Green Building Standards and Codes

- New Construction with Federal Grants
  - ENERGY STAR
    Certified Home or
    Multifamily Mid and High Rise (MFHR)
  - IECC or more advanced energy code

Green Building Standards and Codes

High Rise

- Latest Standard
  - ❑90.1 - 2010
- HUD Default Standard
  - ❑90.1 - 2004

ASHRAE™

American Society of Heating, Refrigerating & Air Conditioning Engineers

2012 IECC

America's primary residential energy code is the International Energy Conservation Code or IECC.

2012 IECC-regulated features will use 30% less energy compared to those that comply with the 2006 IECC

•Regulated features:
- Insulation & Fenestration
- Infiltration limits
- Duct insulation, sealing, and testing
- HVAC controls
- Equipment sizing
- Dampers
- Lighting

Courtesy PSL Integrated Solutions

Green Building Standards and Codes

•HUD Standard
- IECC 2006

•Latest Standard
- IECC 2012

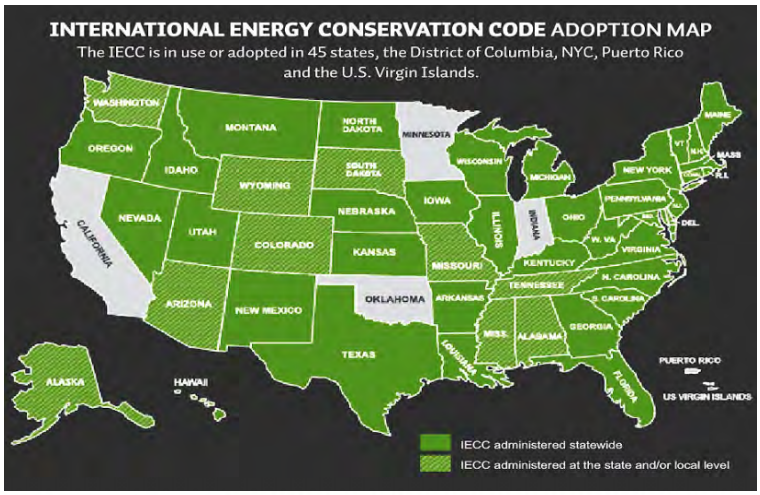
ICC
INTERNATIONAL CODE COUNCIL

2012 INTERNATIONAL ENERGY CONSERVATION CODE

A Member of the International Code Family

2012 IECC

Green Building Standards and Codes



Insulation and Fenestration Requirements

Minimum R-values

- Roofs
- Walls
- Foundations

R-value indicates resistance to heat flow; higher in cold climates

Maximum U-values

- Windows
- Skylights

U-value = 1/R-value; lower in cold climates

Maximum SHGC

- Skylights
- Windows

Solar Heat Gain Coefficient; lower in warm climates

Courtesy PSL Integrated Solutions

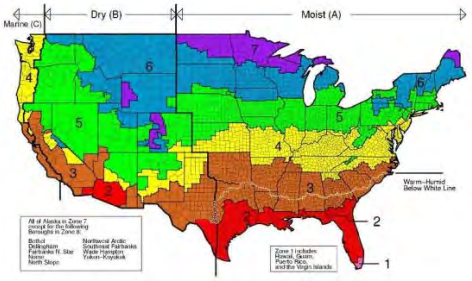


TABLE R402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b,e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13+5[h]	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

Insulation Requirements
IECC vs. "Above Code" Programs

(Climate Zone 5 used for all values)	IECC 2009	IECC 2012	ENERGY STAR v3	LEED FOR HOMES*
Ceiling insulation	R38	R49	R38	Credit
2x6 ext. studs or 1" rigid insulation (R13 + 5)	x	x	x	Credit
Foundation wall insulation R-value (continuous or cavity)	10/13	15/19	10/13	Credit
Windows U-value	< 0.35	< 0.32	< 0.30	< 0.35

Courtesy PSL Integrated Solutions

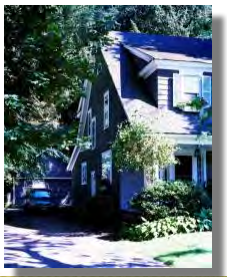
Green Building
Standards and Codes

ENERGY STAR for New Homes

Includes ENERGY STAR for new construction Low-Rise Residential Units

ENERGY STAR Qualified Multifamily High Rise Buildings

for new or substantially rehabilitated



Green Building Standards and Codes

1. New Construction with federal grants
2. Other new construction with federal resources (such as loans) – current IECC and/or ASHRAE
3. Substantial rehabilitation – measures recommended in Green Capital Needs Assessment
4. Moderate/other rehabilitation – at minimum, Energy Star and WaterSense products and appliances
5. Energy Retrofits – cost-effective measures determined by energy audit

Green Building Standards and Codes

New Construction requirement	Already reflect the requirement	Changes required to reflect the alignment
ENERGY STAR for: •Homes •Multifamily •Builders Challenge	HUD •Choice Neighborhoods •Housing Trust Fund •Neighborhood Stabilization Program-3 •Section 202/Section 811 •Self-Help Ownership Opportunity Program (SHOP)	HUD •HOME Investment Partnerships Program •HOPE VI

Proposed

*******CDBG not included*******

Green Building Standards and Codes

New Construction requirement Minimum	Already reflect the requirement	Changes required to reflect the alignment
• IECC- International Energy Code Council • ASHRAE- America Society of Heating Refrigeration and Air-Conditioning Engineers	HUD •Public Housing Capital Fund •Operating Grants •Multifamily Insurance Programs USDA •Section 515 New Const. •Section 514/16 Farm & Labor Housing •Multifamily Preservation & Revitalization •Section 538 Guaranteed Rural Rental Housing	No Changes

HUD Requirements

HUD Reporting

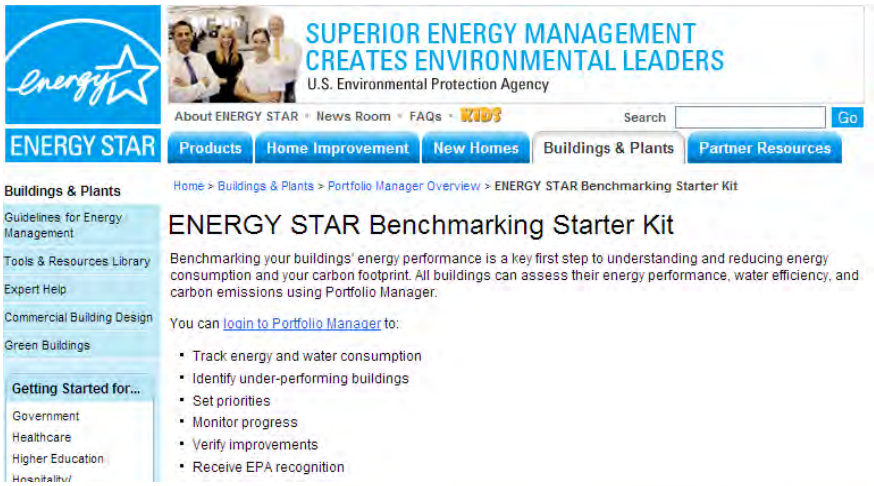
PHAs

•Energy Performance Information Center (EPIC) – Capital Funds - ECMS

CDBG/HOME

•IDIS – EnergyStar units, energy efficiency

Green Building Standards and Codes



Module 11 Reflection and Review

Synthesis