

Meeting DHCR Green Standards for High Performance Housing

Presented by:

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Winter 2007



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Today's Agenda

9:00 – 9:30 Introductions; DHCR Green Building Initiative (GBI)

9:30 – 11:00 High Performance Residential Buildings:
Concepts and Strategies

(break from 11:00 – 11:15)

11:15 – 12:30 Value Engineering and High Performance
1 - 4 Family and Multifamily Homes

(lunch on your own from 12:30 – 1:30)

1:30 – 3:00 Energy Software Tools; Building Rating Systems

3:00 – 4:00 Questions on Today's Presentation and
the DHCR Green Building Initiative



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Building Systems Consultants - Founded 1972

Expertise:

- Energy Efficiency
- Advanced Building Systems
- Indoor Environmental Quality (IEQ)
- Systems Engineering and Optimization

Integrated "Whole Building" Approach



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Why are you here today?

- Your boss made you come
- An employee made you come
- You want to learn more about “green” or high performance buildings
- You have durability, comfort, energy, and affordability issues in some of your buildings



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No, let's be honest, you want the points for your HTF or HOME applications that are due in less than a month.....



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So our joint goals for the day are:

- Explain the components of DHCR's Green Building Initiative
 - Show typical design deficiencies that need to be corrected to exceed NYS Energy Conservation Construction Code
 - Show examples of completed high-performance affordable housing
- AND**
- Design and build affordable housing that is more durable, efficient, comfortable, affordable, and safe



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DHCR Green Building Initiative (GBI)

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DHCR Green Building Initiative

The Green Building Initiative provides HTF or HOME funding to encourage the development of energy efficient residential buildings.

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DHCR Green Building Initiative

Applications must propose projects that include all of the following:

1. Energy efficiency of the project is **30% or greater** than that required by the NYS Energy Conservation Code, as evidenced by the completion of the NYS version of REScheck (www.energycodes.gov/web_tools.stm);

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DHCR Green Building Initiative

Applications must propose projects that include all of the following:

2. Provide **all Energy Star appliances** (including laundry equipment by outside vendors) and lighting; and,



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Applications must propose projects that include all of the following:

3. Provide central heating and cooling plants with sealed combustion chamber; or individual HVAC units that include air conditioners, with sealed combustion chambers within each dwelling unit. No air conditioner sleeves will be permitted.



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Applicants who can demonstrate that they meet the terms of this initiative will be eligible for additional rating points under the HTF and HOME rating systems.



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Community Housing Development Organization (CHDO) applications only:

CHDO home ownership project applicants that are proposing to use HOME Program funds for new construction of housing intended for home ownership will receive scoring preference if they can demonstrate that the proposed project will qualify as Energy Star housing. Multifamily home ownership projects that qualify for Leadership in Energy and Environmental (LEED) certification will also receive scoring preference.



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DHCR Green Building Initiative

To recap:

- Energy usage 30% better than NYSECCC
- All Energy Star appliances and lighting
- Sealed combustion heating systems
- Central or individual apartment unit A/C
- No sleeve or window A/C units
- CHDO Homeownership: Must be Energy Star (1-4); must be LEED if multifamily



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In order to achieve 30% better than NYSECCC, some of our design and construction practices must change.



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High Performance Residential Buildings: Concepts and Strategies



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Basic Terminology

- Sustainable
- Green
- Environmentally-Conscious
- Eco-Friendly
- Energy Efficient
- High-Performance
- Healthy Building



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Basic Terminology

- Single Family Home
- 1 – 4 Family Home
- Low Rise Residential
- Garden Style
- High Rise Residential
- Multi-family



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Why Make Buildings "Green"?

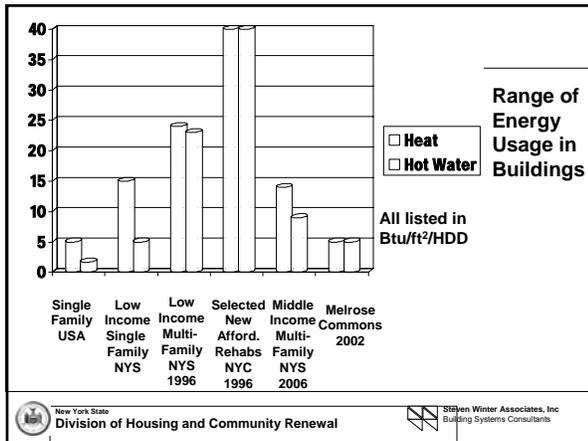
- Environmental responsibility.
 - Annual resource consumption of buildings in the U.S.
 - 30% of overall energy
 - 60% of electricity
 - 5 billion gallons of potable water to flush toilets.
- Reduce operating costs (utility, water, waste management costs).
- Increase occupant productivity through better indoor environmental quality.



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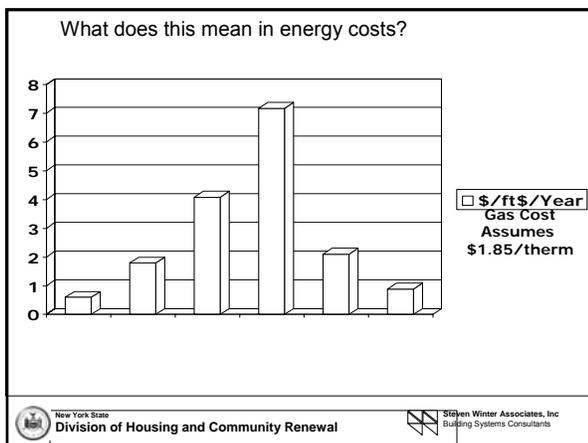
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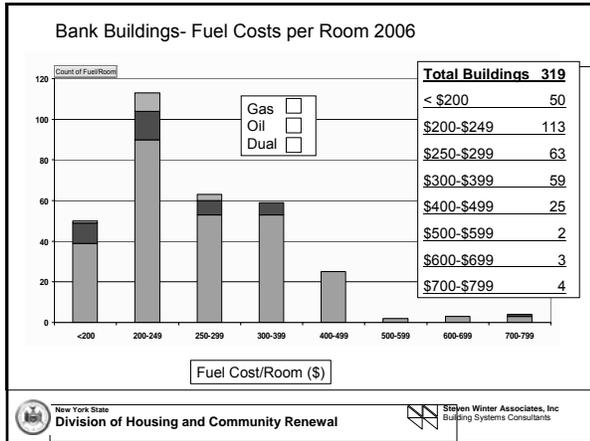
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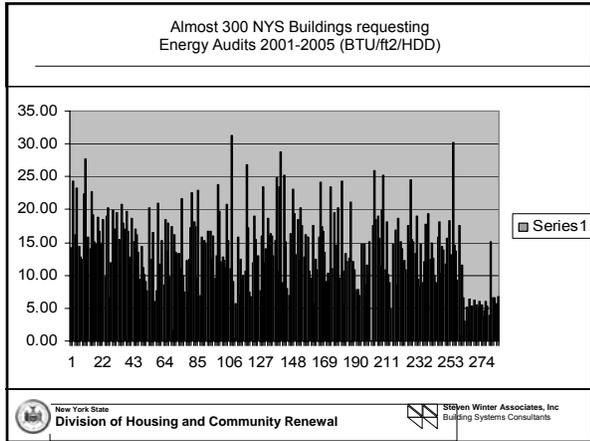


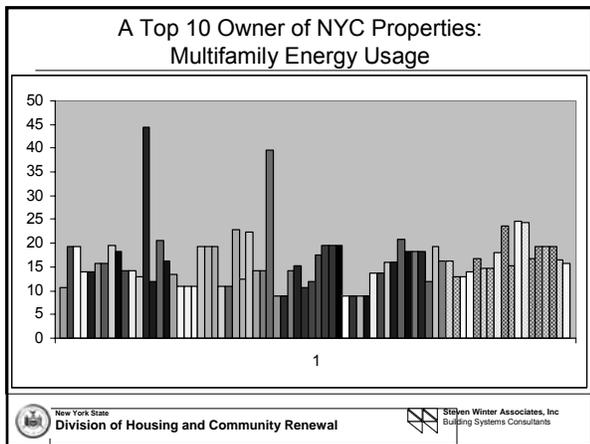
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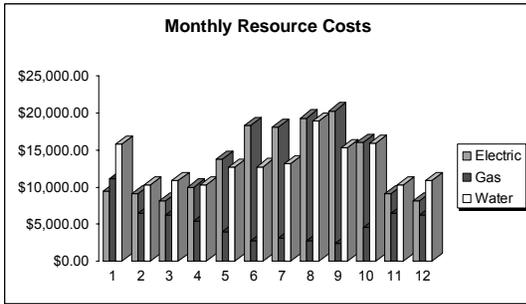
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One Complex, 12 Months, Master Metered



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Rent vs. fuel usage

For a **TWO BEDROOM** Apartment that is **660 SQ. FT.**, and rents for **\$2,000/month**.

Annual Rent Dollars	Annual Fuel Use Therm/ft ²	Annual Fuel Cost (at \$1.85 per therm)	Annual Fuel Use as % of Annual Rent
24,000	.5	611	2.5%
24,000	1	1,221	5.0%
24,000	2	2,442	10.0%
24,000	4	4,884	20.0%

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High Performance Building Design Strategies

- Design and build a better building envelope
- Build tight, ventilate right
- Size the HVAC to the building load (math required)
- Reduce avenues for water penetration



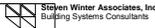
- Specify high efficiency HVAC, appliances, & lighting
- Specify materials with fewer pollutants
- Reduce water usage in buildings
- No unproven technologies, gadgets, or high costs

Remember this?

1. Energy efficiency of the project is 30% or greater than that required by the NYS Energy Conservation Code, as evidenced by the completion of the NYS version of REScheck (www.energycodes.gov/web_tools.stm);



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What are the components of a “green” and 30% better building?

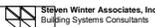


Building “green”

If we build tighter, better insulated, and properly ventilated homes, and we bring fewer poisons into the home, we will have inherently healthier and greener homes.



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Building “green”

It will also reduce callbacks and repeated repairs once the homes are occupied.



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Building “green”

It will also:

- Reduce energy usage by half
- Increase health and safety
- Increase durability
- Make buildings more affordable
- Stabilize occupancy (in rental units)
- Make buildings more comfortable and thereby, reduce complaints



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In the next hour or so, we are going to encourage you to look at doing ten things differently to treat the building as a system. You cannot pick from the list, you must do them all.



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None of this is Rocket Science.

It is primarily combining intelligent technologies that are ten to fifty years old, and all of them are fully proven in the field.

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Top Ten Strategies for Building High Performance

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Top Ten Strategies for Building High Performance

1. Buildings are not sealed well from floor-to-floor and from inside-to-outside.

These leaks of untreated air cause much of the comfort, mold, mildew, and callback problems in the building.

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1. SEALING: Holes around chimneys, piping & ducts



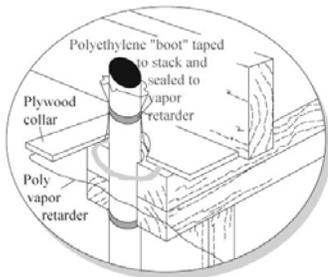
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1. SEALING: Proper sealing of pipe chases:

Figure 4



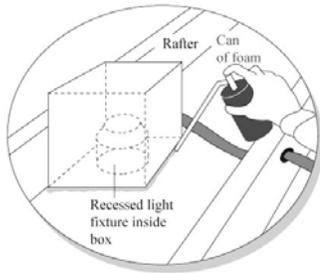
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1. SEALING: Recessed lights – big holes!

Figure 8

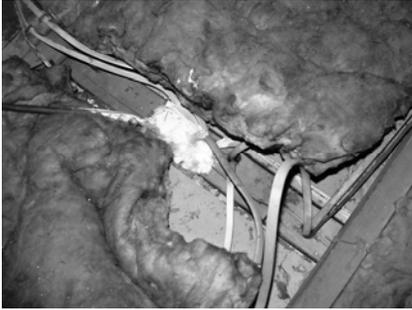


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1. SEALING: Wiring penetrations



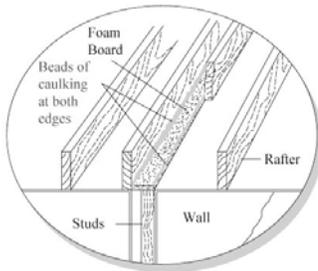
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1. SEALING: Top of interior or exterior walls

Figure 6



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1. SEALING: Details around bathtubs

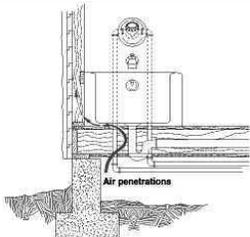


Figure 14 - Block air movement up into bathtub openings with stiff cardboard or gypsum board, caulked and nailed to floor members.



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1. SEALING: Services that enter the building

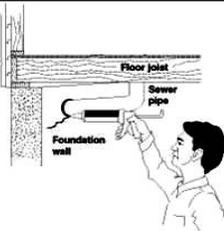


Figure 13 - Caulk any gaps around the openings in the basement wall through which services (electrical, plumbing, heating) enter the house.



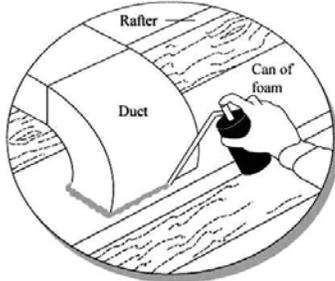
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1. SEALING: Duct penetrations

Figure 5



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1. SEALING: Specifications needed

- Airsealing details for trades
- Installation guidelines, including doors, windows, etc., that include airsealing
- Guidelines for airsealing attic and roof cavities
- Airsealing from floor to floor and in walls (oops, also required by Fire Code)



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1. SEALING: Healthy and Green Effects?

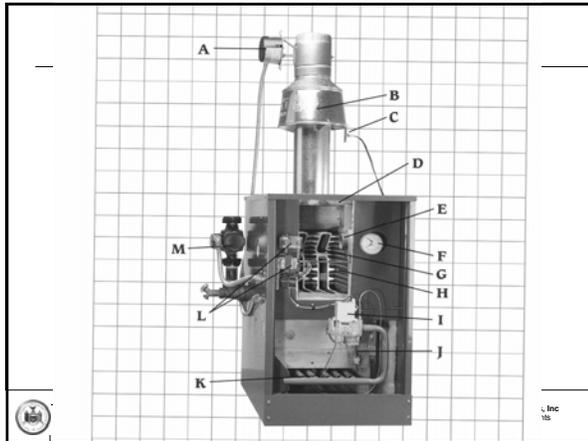
- Less unplanned air coming into the building
- Less warm moist air escaping into roof or attic (rot and ice dams)
- Less cold dry air entering lower floors and causing comfort problems

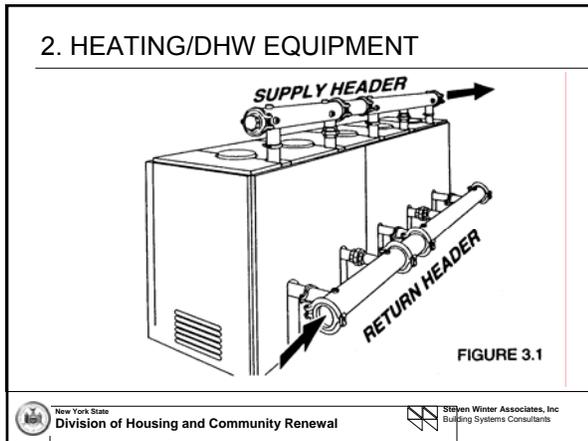
Wait, what was DHCR GBI Requirement #3?

3. Provide central heating and cooling plants with sealed combustion chamber; or individual HVAC units that include air conditioners, with sealed combustion chambers within each dwelling unit. No air conditioner sleeves will be permitted.

Top Ten Strategies for Building High Performance

2. Heating and domestic hot water (DHW) systems are the least efficient available on the market, and are typically oversized by a factor of at least two.





2. HEATING/DHW EQUIPMENT

Solutions

- Stop NOT specifying heating systems
- Stop specifying cheap equipment
- Specify high efficiency equipment
- Have the equipment sized to the load
- Make your engineer show the math
- Use fewer number of appliances
- Consider DWH storage from boiler or combined DHW/furnace

2. HEATING/DHW EQUIPMENT

Requirements with DHCR GBI

- Specify sealed combustion heating and DHW for single family or individual apartments
- With larger central systems, specify high efficiency systems with fully modulating burners
- Specify condensing and other high-efficiency alternatives
- Heating and DHW equipment must get air directly from outside, either through a sealed pipe designed by the manufacturer for the combustion unit; or directly from the outside in a fully compartmentalized equipment room (air and fire sealed from the rest of the building)
- Atmospheric gas systems not acceptable



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2. HEATING/DHW EQUIPMENT

Healthy and Green Effects?

- Properly sized efficient equipment uses less fuel (reduced greenhouse gas and particulates)
- Sealed combustion appliances remove backdrafting, spillage, and CO related health problems (like rapid death)
- One appliance with good controls reduces possibility of overheating building and water and related health problems



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2. HEATING/DHW EQUIPMENT

Alternatives to Sleeve A/C:

- Individual unit split system with A/C sized properly to load and SEER 12 or more
- Central cooling sized to load and provided through fan coil or ducted system in each apartment



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3. Insulation is incorrectly or poorly installed, or sometimes not installed at all.



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3. INSULATION

Solutions:

- Train and oversee insulation subs
- Fit insulation in place and cut around plumbing and wiring boxes to fit in place without compression
- Change framing practices; specify framing to be optimum value engineered (OVE) framing
- See details next section



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3. INSULATION

Healthy and Green Effects?

- No cold spots, no condensation, less potential for mold and mildew
- Good insulation increases comfort and need to overheat
- Well insulated buildings use less energy, less greenhouse gasses



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4. The combination of metal studs and masonry walls causes a thermal breakdown, or “bridging,” of cold temperatures into the building, causing insulation degradation and “ghosting” of studs on sheetrock walls. This is less pronounced, but still occurs, with wood framing.



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4. MITIGATE THERMAL BRIDGING



This framing detail cannot be fixed.

This header for a window will conduct the cold from the masonry and can only be partially improved by filling with expanding spray foam.



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4. MITIGATE THERMAL BRIDGING



This corner cannot be insulated, and will be a thermal bridge for the life of the building.

Even though the studs are pulled away from the masonry wall to mitigate the thermal bridge, there is no insulation between the stud and the wall, which would be the best solution.



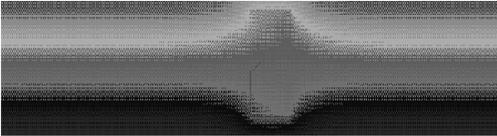
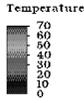
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4. MITIGATE THERMAL BRIDGING

Assembly modeled without 5/8" Insulation: 3/8" interior gypsum sheathing, steel studs R-11 fiberglass, 5/8" exterior gypsum sheathing achieves an Assembly R-value of R-7. Minimum Interior Surface Temperature: 51°F (with an outdoor temperature of 0°F)



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4. MITIGATE THERMAL BRIDGING



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4. MITIGATE THERMAL BRIDGING

Solutions:

- Read NAHB info on OVE framing
- Specify 24"oc framing and reduce corners to 2 stud
- Reduce framing practices that degrade insulation effectiveness
- Use EPS or cellulose insulation between metal studs and masonry
- Move insulation to the outside
- Note that this is a problem with all framing types



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4. MITIGATE THERMAL BRIDGING

Healthy and Green Effects?

- Better framing techniques, particularly with metal, reduces cold spots and possible condensation points
- Good framing practices reduce framing materials and provide greater structural integrity
- Sturdier homes with less material?
Sounds environmentally sound!



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5. Ventilation systems are not properly sized or balanced, and perform poorly.



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5. VENTILATION SYSTEMS

Problems:

- Poorly specified
- Cheap fans that cannot run quietly
- Separate fans for each group of baths and kitchens
- Systems never balanced
- Can cause increased stack effect



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5. VENTILATION SYSTEMS

Solutions

- Use high efficiency Energy Star quiet fans individually for each unit; or
- Tie baths and/or kitchens together and use constant air regulators (CAR – manufactured by Aldes) to guarantee proper ventilation in each unit; roof fans highest efficiency!
- Run fans continuously in tight buildings
- Consider heat recovery ventilators (HRV) in high performance buildings
- Note: Fans vent easier through the wall for each unit; roof fans must vent to roof, not attic



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5. VENTILATION SYSTEMS

Healthy Effects?

- Do we really have to tell you how good it is to have fresh air in a controlled amount in residential buildings?



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6. Poor window specifications and resistance to the use of vinyl or other higher performing windows.



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5. WINDOWS

New windows need to have:

- Continuous thermally broken frame
- Minimum double pane
- Frame that conducts less heat/cold
- Proper installation procedures
- Low emissivity (low-e) coatings particular to your region
- Overall R-Value established by NFRC



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6. WINDOW SPECIFICATION

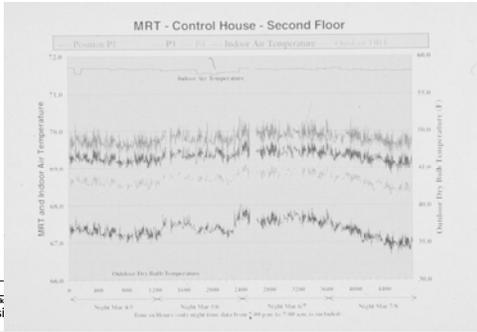
Measuring Effectiveness of Low-E Coatings



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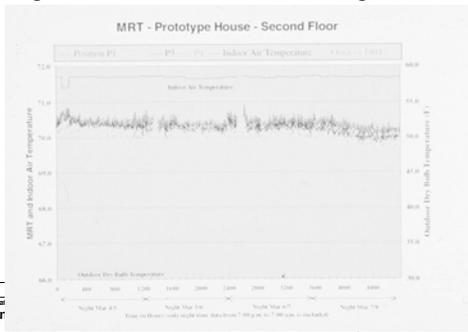
6. WINDOW SPECIFICATION

Measuring Effectiveness of Low-E Coatings



6. WINDOW SPECIFICATION

Measuring Effectiveness of Low-E Coatings



6. WINDOW SPECIFICATION

Healthy and Green Effects?

- Good windows = great comfort
- More comfort = less energy
- Less energy = less greenhouse gasses and particulates

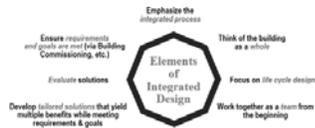
Top Ten Strategies for Building High Performance

7. Poor construction management and little if any penalty for contractors that do not follow specifications.

7. CONSTRUCTION MANAGEMENT

The Integrated Design Process

To create a successful high-performance building, an interactive approach to the design process is required.



7. CONSTRUCTION MANAGEMENT

Working as a Team

It is necessary for the people responsible for the building design to interact closely throughout the design and construction process.

This does not mean that the client, architects, engineers, contractors and consultants simply need to talk or attend their traditional meetings.

7. CONSTRUCTION MANAGEMENT

Working as a Team

It means everyone involved in the use, operation, construction and design of the facility must fully understand the issues and concerns of all the other parties.



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Wait, what was DHCR GBI Requirement #2?

2. Provide all Energy Star appliances (including laundry equipment by outside vendors) and lighting



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8. Electricity concerns are ignored, even when Energy Star lights and appliances cost almost the same but use up to 75% less energy.



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8. ELECTRICITY

Electricity math:

- Every watt in NYC that runs 24/7 costs \$1.31 @ .15¢/kwh
- A 75 watt incandescent bulb costs \$98.25 + 8 bulbs to run for a year
- A 22 watt fluorescent bulb costs \$28.82 to run for a year
- An Energy Star 15 cubic foot refrigerator uses \$60 less in electricity per year than the cheapest model



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8. ELECTRICITY

Assumptions: 15 cent per kilowatt hour; incandescent bulbs cost .50 cents and last 1200 hours; Compact fluorescent lights (CFL's) cost \$4 and last 10,000 hours

Usage Patterns	100 Watt Bulb	75 Watt Bulb	25 W fluorescent	20 W fluorescent	Additional Upside
24 hours per day annual cost of electricity + replacement bulbs	$\$131 + 6 \times .50 = \134	$\$98.25 + 8 = \106.25	$\$32.85 + \$4 = \$36.85$	$\$26.25 + \$4 = \$30.25$	Fluorescent bulb will last minimum 2 months into next year
12 hours per day annual cost of electricity + replacement bulbs	$\$65.50 + 1.50 = \67.00	$\$49.25 + \$1.50 = \$50.75$	$\$16.40 + \$4 = \$20.40$	$\$13.10 + \$4 = \$17.10$	Fluorescent bulb will last minimum 1 year and three months after first year
6 hours per day annual cost of electricity + replacement bulbs	$\$32.25 + \$1.00 = \$33.25$	$\$24.50 + 1.00 = \25.50	$\$8.20 + \$4 = \$12.20$	$\$6.50 + \$4 = \$10.50$	Fluorescent bulb will last minimum 3.5 more years
3 hours per day annual cost of electricity + replacement bulbs	$\$16.00 + .50 = \16.50	$\$12.25 + .50 = \12.75	$\$4.00 + \$4 = \$8.00$	$\$3.25 + \$4 = \$7.25$	Fluorescent bulb will last minimum 8 more years
1 hour per day annual cost of electricity + replacement bulbs	$\$5.00 + .50 = \5.50	$\$4.10 + .50 = \4.60	$\$1.40 + \$4 = \$5.40$	$\$1.00 + \$4 = \$5.00$	Fluorescent Bulb will last 26 more years



8. ELECTRICITY

Electricity solutions:

- Specify Energy Star (ES) lighting: all bulbs, all fixtures, all exit lights
- Specify ES appliances: refrigerators, dishwashers, washing machines (even contracted from laundry services), ventilation fans, etc.
- Specify high efficiency motors (MotorMaster computer software free!)
- Use incentives available through NYSERDA or utilities for electrical upgrades



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8. ELECTRICITY

Healthy and Green Effects?

- Electricity is typically generated from fossil fuels at an efficiency of about 35% from the plant to the plug
- Using less reduces greenhouse gasses, particulates, and the need to build more power plants



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Top Ten Strategies for Building High Performance

9. Devices That Use Water and Hot Water Consume More Than They Should, and Hot Water is Dangerously Hot



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9. WATER USAGE

Largest Water Consuming Devices

- Toilets, even low flow
- Showers, low flow are typically not
- Faucet aerators are typically not tested



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9. WATER USAGE

Solutions:

- Specify showerheads tested and approved by NYC DEP and/or Consumer Reports
- Specify toilets tested and approved by Canadian–American Consortium (MaP—Maximum Performance Testing)
www.cwwa.ca



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9. WATER USAGE

Hot Water Problems

- If separate systems, typically undersized and set too high
- If part of heating system, poor controls, poor mixing/anti-scald valves, and temperatures set too high
- Water by code must be 115°F to 120° F minimum in NYS – no high limit
- 137° F water burns human skin



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9. WATER USAGE

Solutions to Hot Water Waste

- Size systems properly, keep temperatures safe
- Use proper mixing valves that have anti-scald safety
- Run circulation loop 24 hours and insulate all interior DHW piping



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9. WATER USAGE

Healthy and Green effects?

- Reduced water and DHW usage
- Less scalding injuries (children)
- Reduce DHW fuel usage (typically 50% of gas or oil use in NYC)



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Top Ten Strategies for Building High Performance

10. Health and safety issues are not specified for workers or occupants, increasing the chances of worker injury and occupant sickness or death.



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10. HEALTH AND SAFETY

Real Health Effects: Less Poisons!

- Use real wood products, not glue and formaldehyde enhanced ones
- Use low volatile organic compound (VOC) paints, sealants, cleaners
- Reduce carpet, use lower pile carpet
- Educate owners/renters about product safety
- Get Material Safety Data Sheets (MSDS) for all materials



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QUESTIONS?

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Examples of High-Performance, Energy Star, and LEED Affordable Housing

Real Value Engineering Solutions

1-4 and MF Housing

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OFFICE OF
BUILDING TECHNOLOGY
STATE AND COMMUNITY PROGRAMS

U.S. Department of Energy

Building
AMERICA



A **PATH** Partner

BUILDING AMERICA

Consortium for Advanced Residential Buildings (CARB)



- ◆ **Located:** Norwalk, CT
- ◆ **Lead:** Steven Winter Associates, Inc.
- ◆ **Members:** 12 Builders
24 Suppliers
16 Supporting organizations
- ◆ **Mission:** To achieve significant and measurable improvements in housing and energy performance in large numbers of housing units.



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Performance Optimization Through Whole-Building Design

- **BUILDING PLANNING:** Simplified envelope configuration planned on a 2' module
- **DESIGN SYSTEMS TOGETHER:** Building systems are designed in concert with each other to optimize performance
- **VALUE ENGINEER** each independent system. Optimize material and labor, reduce waste, lower cost



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Major Building Systems Affecting Performance In Cold Climates

- **Building Envelope**
 - Air-tightness, Insulation levels
 - Water-management
- **Windows and Glazing Systems**
 - Glazing SHGC
 - Overall “U” Value
- **HVAC Equipment**
 - Equipment sizing, efficiency and location
 - Duct tightness, distribution effectiveness, and location



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Major Building Systems Affecting Performance In Mixed-Humid Climates

- **Domestic Hot Water**
 - Generation
 - Distribution
 - Stand-by-losses
- **Appliances**
 - Refrigerator, dishwasher, clothes washer/dryer
- **Lighting and miscellaneous**



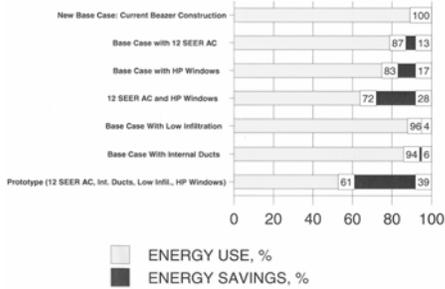
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Whole-House Design Specifications Level

Computer Modeled Energy Savings



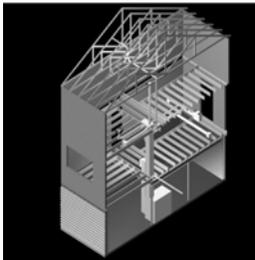
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Whole-House Design

Systems Integration Level



- **“Right-Sized” HVAC**
 - Manual J with no oversize
- **Compact design**
 - avoids ducts in outside walls
 - Less opportunity for leaks and losses
 - Less costly to install
 - Better able to achieve air-flows



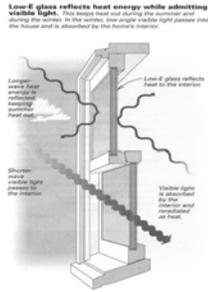
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Low-e Glass and Downsizing AC

- Low-e glass lowers the solar heat gain coefficient (SHGC) by blocking out most long-wave radiation (heat) while allowing most of the short-wave radiation (light) to enter.
- Target SHGC: 0.40 or less.
- Cutting heat gain = less peak load on AC.
- Downsizing AC liberates cash, which helps pay for low-e glass.



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Typical Costs

- Extra cost for 300 SF low-e coating on double glazing: \$300.
 - Savings in downsizing AC by 1/2 ton: \$275.
- Net cost: \$25.

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Claretian Associates South Chicago, IL Single Family Example



- 25 Home In-fill Development
- Panelized SIP Construction
 - R-24 Walls
 - R-40 Roofs
- 92 AFUE Furnaces
- Mastic Sealed Ducts
- 1.2-kW PV Solar Systems
- Low-e Windows
- EnergyStar Appliances
- Compact Fluorescent Lighting
- Controlled Ventilation

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Eaton Row HOPE VI



- Modular-hybrid construction
 - Porches/garages/deck site built
- R-19 walls, R-38 ceilings
- Low-e windows
- Compact HVAC design
- 92% AFUE furnaces
- Tankless water-heaters
- Controlled ventilation
- PEX supply piping
- TREX decking

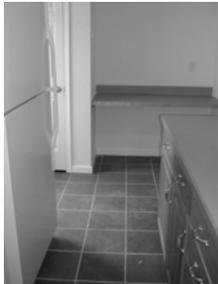


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Eaton Row HOPE VI



Durable High-Traffic Area Floors



Abundant Natural Light



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Eaton Row HOPE VI



- Project is completed
- All units were pre-sold (with a profit!)
- Price range: 130k to 195k
- Extremely affordable for area
- HERS scores of 88, 40% better than MEC



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NextGen Manufactured Home Example



- Two-Story HUD Code Home
- Hinged Roof
- Permanent Basement Foundation
- Compact Integrated HVAC
- Tankless Water-Heater with Hydro-coil Air-Handler
- PEX Plumbing
- Flexible Gas Piping



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Energy Star Manufactured Home Example

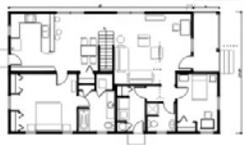
- Home is manufactured in an Energy Star Certified Plant which has undergone rigorous inspections.
- Homes undergo random field testing.
- Home delivers comfort, durability, and energy savings for years to come.



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- 1344 SF Living Area Plus 2nd Floor
- \$100,000 cost (excluding land)
- \$175 Savings per Year on Energy



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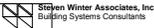
Building Envelope



Precast Concrete Wall Panels



Aluminum Siding on Rear of Buildings

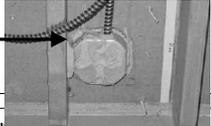
Envelope Details



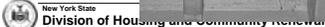
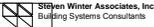
Rigid Insulation Thermal Break



Low-e Glazing Vinyl Frame



Air-Sealing With Mastic

Mechanical Equipment

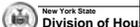


Outdoor Reset Control

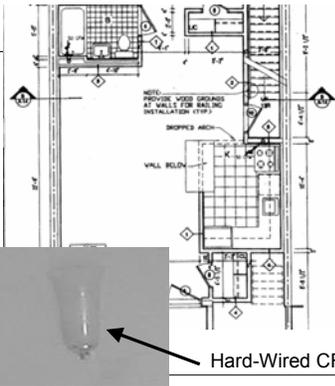


Sealed Combustion Boiler

Indirect DHW Tank




Lights and Appliances

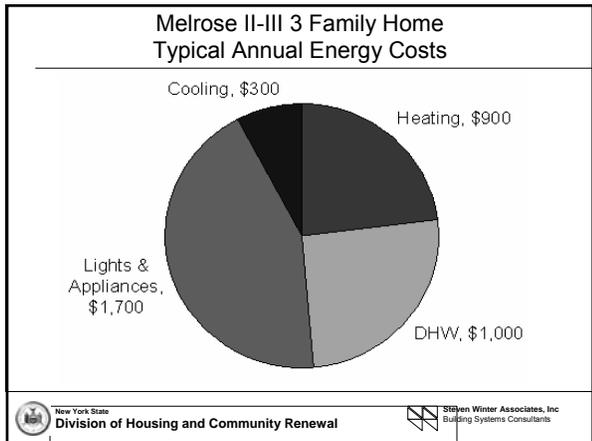



50 CFM Continuous Exhaust

Hard-Wired CFLs

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IMPROVEMENT	COST
1/2" rigid insulation on outside of studs and R-11 batts between studs	\$675
Double glazed low-e vinyl windows	\$896
High efficiency, 60-gallon indirect water heater	\$928
87% efficient 164kBtuh sealed combustion direct-vent boiler	\$1,897

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Difference to Developer

- In 2002-3, coldest winter in many years, 25% colder than normal, 35% colder than previous year
- Thirty three-family homes in the South Bronx
- Zero complaints of comfort, heat, hot water, mold, mildew, moisture, indoor air quality, asthma, or neighbors' quirky habits!



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DUNN DEVELOPMENT CORP.
1212 MLK Apartments

The First Energy Star Mid Rise or High Rise Multifamily Building in the country



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High Efficiency (87%) Boilers provide heat and hot water

6" polyisocyanurate roof insulation, R-37

Custom Double Pane, Low-e Windows

Walls insulated with Roxul® mineral wool insulation and fiberglass batts, R-18

Uses 20% less energy than ASHRAE 90.1-2004 building

DensArmor™ Plus Gypsum Board reduces potential for mold



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Building walls at 1212 MLK Apartments are insulated with 1-inch of Roxul® rigid mineral wool insulation and R-13 fiberglass batts within the interior steel framing.

Rigid insulation, placed between the steel studs and the CMU block wall, minimizes thermal bridging through the steel.

DensArmor™ Plus gypsum board was used on perimeter walls in place of traditional gypsum board. It features a glass mat face on each side of the wall board that results in an entirely paperless product, minimizing the potential for mold growth.



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Two 87% efficient, direct-vent natural gas Lochinvar® boilers meet heating needs—a significant improvement over conventional 80% efficient atmospheric equipment.



Two 119-gallon indirect hot water heaters are used in combination with these boilers to meet domestic hot water (DHW) needs at 1212 MLK Apartments.

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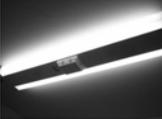


Fluorescent lighting with electronic ballasts brighten hallways, the lobby, stairwells, offices, community room and laundry room. All exit signs are low watt LED.

Apartment fixtures are all compact fluorescent or use low-watt twin tube bix lamps.



Occupancy sensors in offices and common areas automatically turn lights off when these rooms are not in use. Hallway sensors turn overhead lights on as needed.



ENERGY STAR qualified lighting provides bright, warm light while it requires 2/3 less energy than standard lighting, generates 70% less heat and lasts up to 10 times longer.

Over 200,000 kWh of electricity is saved at 1212 MLK Apartments by using fluorescent instead of traditional lighting.

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Tall multifamily
buildings experience more severe wind and stack effect driving forces for infiltration.

These fluctuating driving forces can significantly pressurize some apartments while significantly depressurizing other apartments, making balancing a ventilation system difficult. Ventilation is necessary to maintain healthy indoor air quality.

Aldes CAR dampers
(Constant Air Regulator) dampers are attached to each bathroom exhaust ventilation point.

CAR dampers incorporate a silicone bulb that expands when the pressure drop across the damper exceeds 50 Pa in order to regulate air flow. This ensures proper ventilation balancing in all units.



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Performance Testing





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Stebbins-Bristow LEED for Homes





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1400 Fifth Avenue: NYS Green Building Tax Credit

- Higher levels of insulation in the walls and roof.
- Low E Glazing
- Hardwired Compact Fluorescent Lighting
- Geothermal Heat Pumps
- GFX heat exchangers to recapture heat from shower drains
- Low VOC paints, recycled carpet, bamboo flooring



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Targeting 30% Goal

Upgraded Specifications

- Advanced Framing
- Engineered Duct System
- Blown-In Insulation (R-22)
- Half-Height Basement Insulation (Polyiso)
- R-40 Attic Insulation
- Vinyl, Double Pane, Low e windows
- Air Sealing to Reduce Infiltration
- ECM Motor on Furnace
- 100 % Fluorescent Lighting
- Energy Star Appliances
- All Ducts in Conditioned Space & Tightly Sealed
- Direct- or Power- Vented Mechanical Equipment



Special Features

- Advanced Cooling Systems



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COST SAVING STRATEGIES

• UTILIZE ADVANCED FRAMING (O.V.E) TECHNIQUES

- 24” on-center Framing
- In-Line Framing
- Optimized Headers
- Eliminate unnecessary members
- Use Alternate Materials



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COST OF FRAMING A HOUSE

- Rough Framing is the third highest cost associated with home building behind Interiors and Finishes, and Exterior Walls and Envelope. (Means Cost Data 2001)
- Interiors: 37%
- Exterior Walls 17%
- Framing 15%



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HOW MUCH CAN YOU SAVE?

- **Proven Advanced Framing Techniques in use for over twenty years have a track record of savings.**
- **\$1000 for a 2,400 SF house (Building America Program, 2000)**
- **\$900 for a 1,800 SF house (Builder Magazine 1993)**

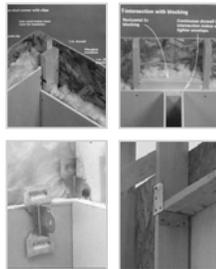
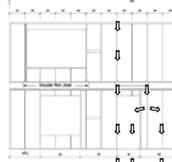
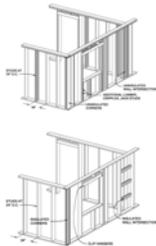


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Advanced Framing Design Concepts



- In Line Framing 24 OC
- Transmit Vertical Loads
- Window/Door Openings Aligned with Framing



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Advanced Framing Design

<p>Framing 16" O.C. Lumber 2943 bd.ft</p>	
<p>Framing 24" O.C. Lumber 2793 bd.ft 5 % Savings</p>	
<p>Framing 24" O.C. Advanced Framing Lumber 2328 bd.ft 21 % Savings</p>	

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Structural Analysis

Floor Framing at 16" on-center

Floor Framing at 24" on-center

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Structural Analysis

In-Line Framing

Direct Load-Path

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Advanced Framing

Inline Framing





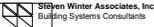
Reduced Waste!







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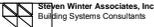
Haphazard Framing Versus Value-Engineered Framing







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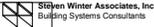


Un-planned Framing Yields Un-planned Result





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- Simple, well thought through concepts are easily conveyed to framing crews with only a short learning curve. Once trained, replication becomes easy.



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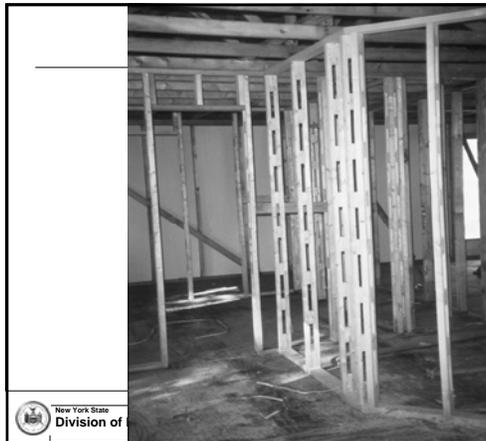


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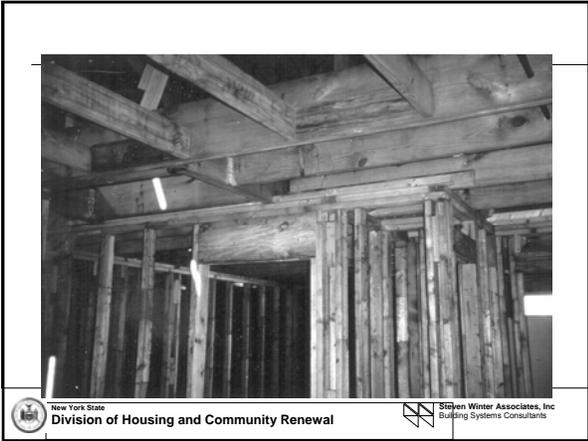
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Avoid Let-in Bracing!



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Waste is Costing you Money



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Compact Duct Design



Open-Web Trusses Facilitate Ductwork Installation



Round Supply Take-offs up to 2nd Floor



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Mastic-Sealed Ducts



Sealing up the Supply Trunk



Mastic applied to all seams



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Rim/Band Insulation



2 Component Spray Foam



Foaming the rim joist



The foam tightly seals all penetrations



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Air Sealing



Air Sealing the Wall Cavity



Spray foam around electrical box



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Blown-In Wall Insulation (R-23)



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Mechanical Ventilation

Exhaust-Only Strategy

- Nutone LS80L Fan/Light Combo
 - Rated for Continuous Operation
 - Energy-Efficient (Measured 20 Watts)
 - Quiet (0.8 Sones)
 - Not Energy Star Rated (Incand. Bulb)
- 80 cfm
- 1 in each Unit
- Remaining baths have "contractor-grade" fans
- Grasslin Pin Timer
- Remote-Wired Control to Closet
- Capable of Complying with ASHRAE 62.2



Nutone Fan and Grasslin Timer Control



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Mechanical Ventilation

Range Exhaust Hood

- Must be vented to the Outside
- NO RECIRCULATING Fans!
- Important to consider in future projects
 - Prevents Fire and Smoke Recirculation
 - Mitigates moisture build-up
 - Removes odors
 - Improves indoor air quality



Avoid Recirculating Exhaust fans!



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Fluorescent Lighting

Lighting Package

- Compact Fluorescent Lamps (CFL)
 - Hard-wired fixtures or screw-in bulbs
 - Many new options
 - Cheaper to operate (66%< energy)
 - Longer life (10X)
- 70% of the Lighting in the home
 - Includes bedrooms, kitchen & hallways
 - May exclude dining and entry
 - Bulbs and fixtures should be E-Star certified
 - Recessed can lights must be air-tight (Labeled IC = Insulation Contact)



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Case Studies



Prototype

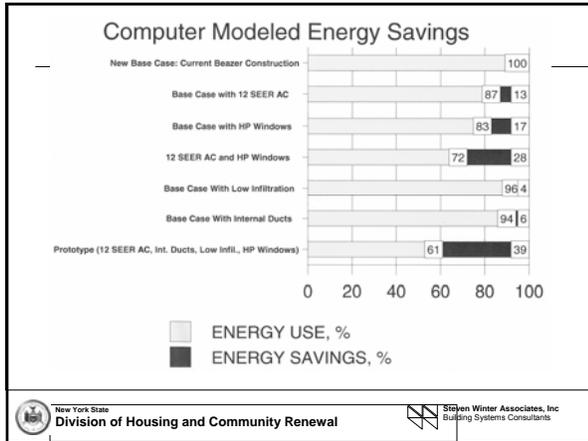


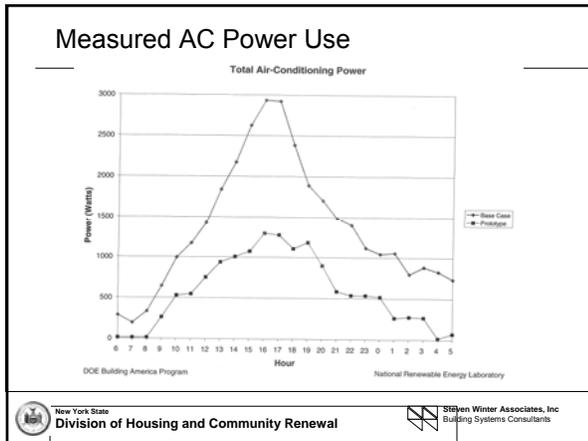
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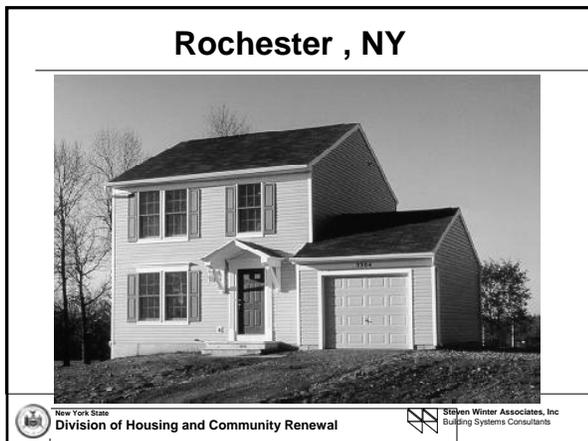


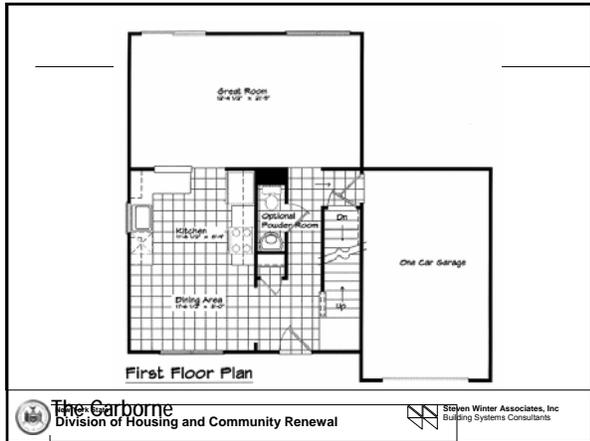
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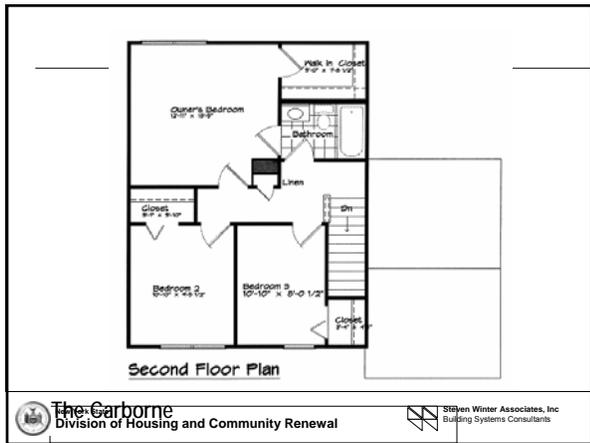
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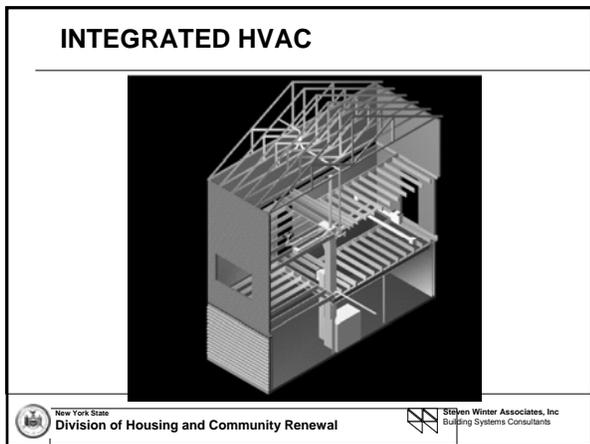












Rochester House Results

- 46% Improvement over code compliant for heating and cooling
- 31% Improvement over standard practice for heating and cooling
- Better comfort with more even radiant temperatures
- Lower build cost per square foot



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COST IMPACTS

• LOW-E HIGH PERFORMANCE WINDOWS	+ \$800
• INCREASE ATTIC INSULATION TO R-30	+ \$250
• REDUCE AIR INFILTRATION ENVELOPE	+ \$200
• REDUCED CAPACITY INSIDE-THE-ENVELOPE HVAC	- \$725
• O.V.E. PARTITION FRAMING	- \$350
TOTAL COST DIFFERENCE	+\$175

Based on a 35% decrease in annual heating and cooling costs, this represents a 0.3 year payback on initial investment.



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Getting to Energy Star Or Equivalent Ratings In Affordable Housing

Identifying the Problems in Existing Affordable Housing
Proposing Changes to "Current Practice"

A Guide for Developers, Architects, Engineers, and Affordable Housing Providers

By Steven Winter Associates, Inc.
Funded by:
The New York City Partnership
U.S. Department of Energy - National Renewable Energy Laboratory
Consortium for Advanced Residential Buildings



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Questions?

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Break for Lunch!

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Energy Modeling Software for Residential Buildings

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New York State
Energy Conservation Construction Code

Select New York from the Code menu

New York Department of State
Code Enforcement and Administration
Visit our website at:
www.dos.state.ny.us/code/energycode/myenergycode.htm

Developed to simplify and clarify code compliance for:

- Model Energy Code (MEC)
- International Energy Code (IEC)
- New York State Energy Conservation Construction Code (ECCNYS)

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REScheck™

REScheck performs a simple U-factor x Area (UA) calculation for each building assembly to determine the overall UA of your building.

The UA that would result from a building conforming to the code requirements is compared against the UA for your building.

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REScheck™

Appropriate for insulation and window trade-off calculations in:

- Residential detached one- and two-family buildings (referred to as single-family buildings)
- Multifamily buildings (such as apartments, condominiums, townhouses, and rowhouses).

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Multifamily buildings include residential buildings three stories or less in height with three or more attached dwelling units.

Multifamily buildings can be considered as a whole or separate reports can be generated for each dwelling unit .



REScheck™

If the total heat loss (represented as a UA) through the envelope of your building does not exceed the total heat loss from the same building conforming to the code, then the software declares that you pass.

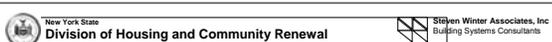
A high-efficiency equipment trade-off can also be performed.

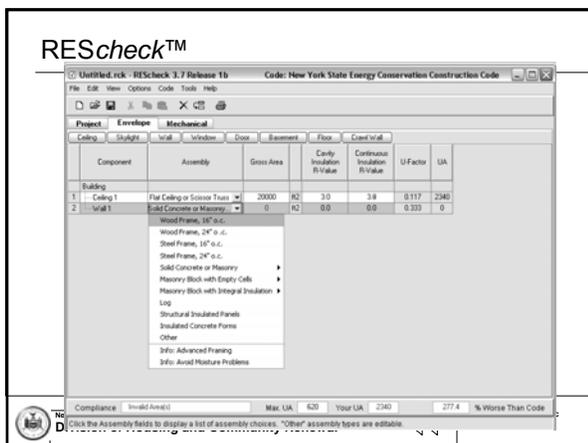
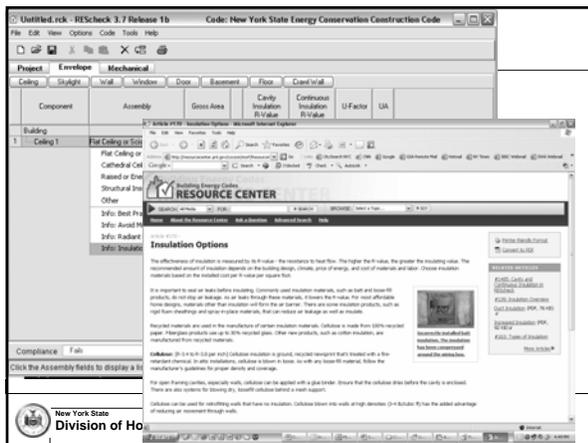
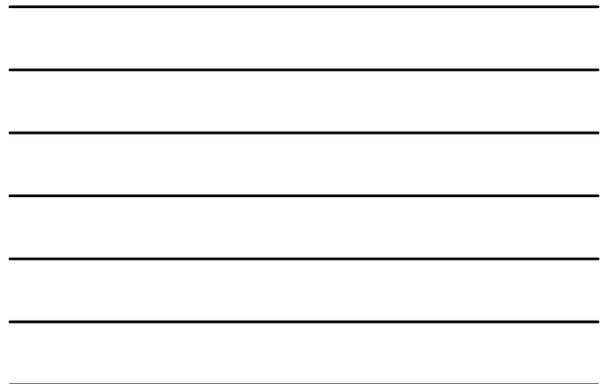
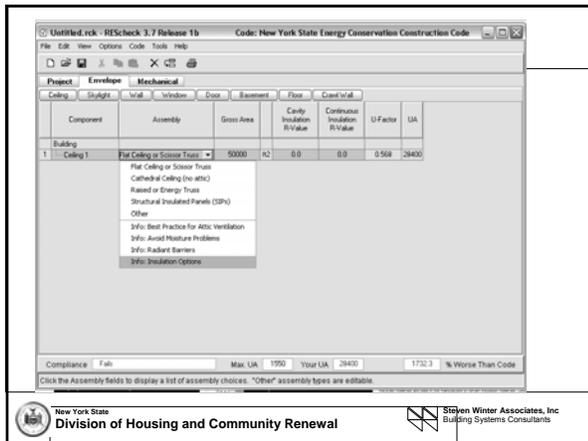


REScheck™

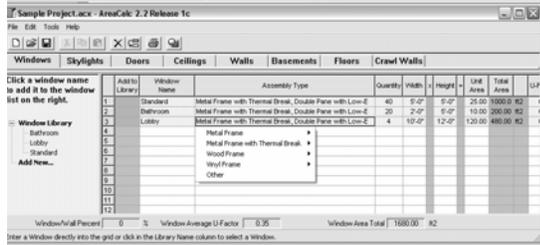
Input

- Component types (e.g., ceiling with attic)
- Insulation R-values
- Glazing and door U-values
- Building location
- Heating equipment efficiency (optional).





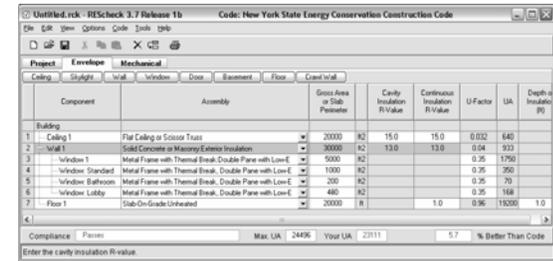
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Output

- Automatically generates a report which can be submitted for plan review; lists project data and compliance results.



Project Title: Sample New York Apartment
Report Code: 814286

Energy Code: New York State Energy Conservation Construction Code
Local Code: New York County, New York
Construction Type: Residential
Report Title: REScheck

Construction Site: 123 Main Street, Albany, NY 12201
Client: ABC Company
Contract Date: 01/01/2008

Owner/Agent: ABC Company, 456 Broadway Street, New York, NY 10012
Designer/Contractor: XYZ Architects, 789 Park Avenue, New York, NY 10022

Assembly	Gross Area of Sub-Elements	Cavity Insulation R-Value	Continuous Insulation R-Value	U-Factor	UA	Depth of Insulation (ft)
Ceiling 1 - Flat Ceiling or Sloped Truss	20000	15.0	15.0	0.032	640	
Wall 1 - Slab Concrete or Masonry/Exterior Insulation	30000	13.0	13.0	0.04	513	
Window 1	5000			0.25	1250	
Window Standard	1000			0.25	250	
Window Bathroom	200			0.25	50	
Window Lobby	480			0.25	118	
Floor 1 - Slab-On-Grade Unheated	20000		1.0	0.96	19200	1.0

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REScheck™

- Available for free on the Department of Energy Website: www.energycodes.gov/rescheck/
- Download software to your computer or use the web-based version
- PDF User Manual available
- Online technical support for software and energy codes



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You can use COMcheck™ to demonstrate that your commercial or high-rise residential building design complies with the ASHRAE/IESNA Standard 90.1- The American Society of Heating, Refrigerating and Air-Conditioning Engineers/Illumination Engineering Society Standard 90.1-1999/2004.



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Other Energy Modeling Software Tools

DOE-2

- Hourly, whole-building energy analysis program calculating energy performance and life-cycle cost of operation.
- Can be used to analyze energy efficiency of given designs or efficiency of new technologies.
- Other uses include utility demand-side management and rebate programs, development and implementation of energy efficiency standards and compliance certification.



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Other Energy Modeling Software Tools

DOE-2

- **Strengths**

- Detailed, hourly, whole-building energy analysis of multiple zones in buildings of complex design; widely recognized as the industry standard.

- **Weaknesses**

- High level of user knowledge.



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Other Energy Modeling Software Tools

TREAT

- Performs hourly simulations for single family, multifamily and mobile homes. Comprehensive analysis tool includes tools for retrofitting heating and cooling systems, building envelopes (insulation and infiltration), windows and doors, hot water, ventilation, lighting and appliances, and more.
- Weather normalizes utility bills for comparison to performance of model.
- Highly accurate calculations which consider waste heat (baseload), solar heat gain, and fully interacted energy savings calculations. Create individual energy improvements or packages of interactive improvements.
- Performs HERS ratings and load sizing. Generates XML file for upload to online database tracking systems.



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Other Energy Modeling Software Tools

TREAT

- **Strengths**

- Comprehensive and highly flexible whole building retrofit tool, easy to use graphic user interface which includes libraries of building components (walls / surfaces, windows, doors, appliances, lighting, heating and cooling, and hot water). Performs utility billing analysis including weather normalization.
- Calculations consider solar heat gain and waste heat generated by baseload and fully interacted savings from energy retrofit measures.



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Other Energy Modeling Software Tools

EA-QUIP

- Analyzes energy use and energy conservation measure opportunities in both single and multi-family dwellings.
- EA-QUIP determines economically optimal mixes of energy-saving measures for a given building and within a chosen budget, for which it uses retrofit and cost libraries.
- EA-QUIP provides pre formatted energy and economics reports.



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Other Energy Modeling Software Tools

EA-QUIP

- **Strengths**
 - User-friendly and easy to use.
 - For energy auditors and energy policy makers who are more interested in the most desirable energy-saving combination of retrofits, EA-QUIP is able to answer this question in an automated process consisting of two stages: the selection of retrofits, and their economic optimization.



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To learn more about energy software

Department of Energy's Building Energy Software Tools Directory

http://www.eere.energy.gov/buildings/tools_directory/



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Building Rating Systems



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What is it?

A rating system for designing, constructing, operating and certifying the world's greenest buildings.



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Why was it created?

- To define "green" by providing a standard for measurement
- To act as a design and construction guideline
- To promote a whole-building, integrated design processes
- To establish market value with recognizable national "brand"
- To transform the marketplace!



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 **LEED** Achievements
LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

1. Wide range of green building issues defined
2. Performance goals established
3. Industry standards cited ("best practice")
4. Built-in flexibility
5. Increased market for green products



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 **LEED** Variations
LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

- New Construction/Major Renovations (NC)
- Existing Buildings (EB)
- Commercial Interiors (CI)
- Core and Shell (CS)
- Homes (H) - *Pilot*
- Neighborhood Development (ND) - *Pilot*

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 **LEED**
LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

- Can be used as a guideline only, OR...
Projects can register with the USGBC
- Requires close integration of the entire project team
- Training and Accreditation available

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Federal Government Use

- General Services Administration (GSA)
- U.S. Army Corps of Engineers
- Department of State

State Government Use

- New Jersey
- New York
- Massachusetts

Local Government

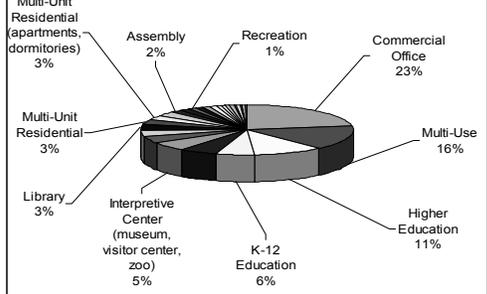
- Arlington, VA
- Los Angeles, CA
- Seattle, WA

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Registered Projects



Project Type	Percentage
Commercial Office	23%
Multi-Use	16%
Higher Education	11%
K-12 Education	6%
Interpretive Center (museum, visitor center)	5%
Multi-Unit Residential	3%
Library	3%
Multi-Unit Residential (apartments, dormitories)	3%
Assembly	2%
Recreation	1%

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FOR MORE INFORMATION...

The **US Green Building Council**

Web site: www.usgbc.org

Email: info@usgbc.org



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ENERGY STAR Homes

ENERGY STAR qualified homes are independently verified to be at least 30% more energy efficient than homes built to the 1993 national Model Energy Code or 15% more efficient than state energy code, whichever is more rigorous.



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ENERGY STAR Homes

These savings are based on heating, cooling, and hot water energy use and are typically achieved through a combination of:

- building envelope upgrades,
- high performance windows,
- controlled air infiltration,
- upgraded heating and air conditioning systems,
- tight duct systems and
- upgraded water-heating equipment.



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ENERGY STAR Homes

These features contribute to improved home quality and homeowner comfort, and to lower energy demand and reduced air pollution. ENERGY STAR also encourages the use of energy-efficient lighting and appliances, as well as features designed to improve indoor air quality.



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What Qualifies as an ENERGY STAR Home?

Any single-family or multi-family residential home that is three stories or less in height can qualify to receive the ENERGY STAR label.

This includes traditional site-constructed homes as well as modular, systems-built (e.g., insulated concrete forms, structurally insulated panels), and HUD-code manufactured homes.



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New York ENERGY STAR® Labeled Homes

- Provides cash incentives to encourage developers to build and owners to purchase energy efficient homes
- Newly constructed 1-4 unit homes
- Up to \$1,500 for builders and \$500 per low-income homeowner



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ENERGY STAR® Multifamily New Construction

- New buildings or gut rehabs of 5 units or more
- 4 Stories and More
- 20% better than reference building based on ASHRAE 90.1-2004 Appendix G
- ENERGY STAR Modeling Partner to assist in design and modeling



The more energy you save,
the more incentive you get!



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Questions about the DHCR Green Building Initiative (GBI)



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Thank you!

Please fill out an evaluation form
before you leave today.



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