



NORTHEAST ENERGY EFFICIENCY PARTNERSHIPS

2009 ENERGY CODE CHANGES MAKING EFFICIENCY WORK

Donald J. Vigneau AIA
Northeast Energy Efficiency Partnerships

WHAT DOES NEEP DO?



FACILITATE PARTNERSHIPS...

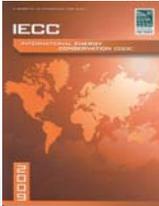
REGIONAL INITIATIVES	PUBLIC POLICY	EM&V FORUM	NEEP SUMMIT
<ul style="list-style-type: none"> High Efficiency Retail Products High Efficiency Home Performance High Efficiency Commercial Buildings and Technologies Workforce Development 	<ul style="list-style-type: none"> Policy Outreach Building Energy Codes High Performance School and Public Buildings Appliance Efficiency Standards 	<ul style="list-style-type: none"> Protocol Development Research and Evaluation Education and Information Access 	<ul style="list-style-type: none"> Conference Workshop Business Leadership Exhibition

TO ADVANCE THE EFFICIENT USE OF ENERGY EFFICIENCY



IECC 2009 CHANGES THAT APPLY TO BOTH RESIDENTIAL AND COMMERCIAL

GENERAL CHANGES



WHAT'S CHANGED SINCE IECC 2006?



- Stringency - some key differences
- New requirements
 - Building envelope tightness
 - Duct testing
 - Lighting equipment
 - Pool controls and covers
 - Snow melt controls
- Moisture control requirements moved to IBC
- No mechanical trade-offs allowed

ADMINISTRATION, GENERAL, DEFINITIONS



- 101.5.2.1 Exc. 3 (plus statutory chgs)
- 3. Buildings and structures for which heating and cooling is supplied solely by utilization of non-purchased renewable energy sources including, but not limited to, on-site wind, on-site water or on-site solar power, or wood-burning heating appliances that do not rely on backup heat from other purchased, non-renewable sources.
- 102.1.1 (ADD)
Such energy efficiency program may include, but not be limited to, the Leadership in Energy and Environmental Design Rating system, the Green Globes USA design program, as established by the Green Building Initiative, the National Green Building Standard, as established by the National Association of Home Builders, or an equivalent rating system approved in accordance with section 29-256a of the Connecticut General Statutes.
- 202 DEFINITIONS
 - Insulation Product Rating

NEW DEFINITIONS

(202)



- Air barrier
- C-Factor
- F-Factor
- Entrance Door
- Storefront
- Daylight Zone
- Demand Control Ventilation
- Fan Systems definitions
- High-Efficiency Lamps
- Listed & Labeled

NEW DEFINITIONS (202 - CT)

(NEW) (Amd) **SUNROOM.** A one-story structure, enclosing a habitable space, with glazing in excess of 40 per cent of the gross area of the exterior walls and roof, and with the area of windows and doors operable to the exterior equal to a minimum of 20 per cent of the area of the sunroom floor.

(NEW) (Add) **FULL CUTOFF LUMINAIRE.** A luminaire that allows no direct light emissions above a horizontal plane through the luminaire's lowest light-emitting part.

(NEW) (Add) **GREENHOUSE.** A one-story structure, enclosing a nonhabitable space, with glazing in excess of 50 per cent of the gross area of the exterior walls and roof.

(NEW) (Amd) **RESIDENTIAL BUILDING.** For this code, includes detached one and two-family dwellings and townhouses, as well as Group R-2, R-3 and R-4 buildings three stories or less in height.

FENESTRATION PERFORMANCE

TABLE 402.1.1 / TABLE 502.3

- NFRC Ratings 303.1.3
 - NFRC 100, U-factors
 - NFRC 200, SHGC
 - Windows, doors, skylights
- Manufactured fenestration
 - Standardized infiltration rates
 - AAMA/WDMA I.S.2, or
 - NFRC 400
- "Site-built" fenestration
 - Caulk, gasket or weather-strip for infiltration control
- Default U-factors & SHGC's 303.1.3



SECTION 402.6.1 - VAPOR RETARDER

(NEW) (Add) 402.6.1 Class III vapor retarder
New vapor retarder requirements allow the use of a coat of vinyl paint to satisfy the requirement when:

- An impermeable insulating sheathing with a value of R-5 is located outside of a 2x4 stud wall with cavities insulated to R-3.4 per inch minimum in Zone 5;
- An impermeable insulating sheathing with a value of R-7.5 is located outside of a 2x6 stud wall with cavities insulated to R-3.4 per inch minimum in Zone 5;



VAPOR RETARDER (CT 402.6) - WILL MOVE



IECC / IRC

Moisture Control

- R302.10.1 Insulation
- R408.1 crawl spaces
- R506.2.3 Slabs
- R601.3 Walls (Table)
- R806.4 Attics
- N1102.2.9 Crawl Space
- M1601.4.5 Ducts
(Was in 402.5/N1102.5)

IBC

Moisture Control

- 202 Definitions
- 719 Insulation facings
- 1203.3.2 Crawl Space.4
- 1405.3 Frame Walls
- 1502 Roofs (general)
- 1910.1 Floor Slabs
(Was in IECC 502.5)

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HOW TO CONTROL VAPOR (MOISTURE)



Control the Leaks





Vigneau Residence
Mansfield Center CT

CONTROLLING THE ENVELOPE

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MOISTURE DIFFUSION IN MATERIALS



MATERIAL	PERM RATING	VAPOR RETARDER(?)
½" GWB	38 -42	NO
TYVEK	52	NO
Latex Primer	7.0 – 10.0	NO
7/16" OSB (w/exterior glue)*	0.77* – 3.48	SOMETIMES
1" XPS	0.40 – 1.60	SOMETIMES
7/16" Plywood (exterior glue)	0.70	YES
Kraft Paper Facing	1.0	YES
2 mil polyethylene	0.06 – 0.22	YES
Alkyd-base or V/R paint	< 0.05	YES
1 mil aluminum foil laminate	< 0.05	YES
½" GWB + VWC	0.05 – 0.80	YES

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POP QUIZ:



IS WATER VAPOR...

LIGHTER THAN AIR?

HEAVIER THAN AIR?

THE SAME?

Does it matter?

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...ANY QUESTIONS?



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RECESSED LIGHTING (402.4.5/502.4.8)

All recessed luminaires installed in the building envelope

- Type IC rated and sealed with gasket or caulk between housing and interior wall or ceiling covering
- Type IC rated and labeled in accordance with ASTM E 283 to allow ≤ 2.0 cfm of air movement from conditioned space to ceiling cavity
- **NO sealed boxes allowed**



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THERMOSTAT CONTROLS 403.1.1 / 503.2.4.1

- One per dwelling - forced air only
- One per ZONE by commercial provisions
- Programmable
- Heat or AC or HVAC
- Deadband $\geq 5^{\circ}$ F



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DESIGN LOADS/EQUIPMENT SIZING 403.6 503.2.1

ACCA Standards

- J - Load Calculations
- S - Equipment Selection
- D - Duct Design
- ASHRAE/ACCA 183



<http://www.acca.org/store/product.php?pid=97>

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SNOW MELTING SYSTEMS (NEW) 

- 403.8
- 503.2.4.5

Snowmelt Systems Automatic Controls

- Provide shutdown when pavement temperature > 50°F with no precipitation falling;
- Shutdown when air temperature > 40°F

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POOL REQUIREMENTS 403.9 / 504.7 

- Pool heaters
 - Readily accessible on-off switch
 - Natural gas or LPG fired pool heaters will not have continuously burning pilot lights
- No changes to other Service Water requirements



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POOL HEATERS

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ENVELOPE REQUIREMENT CHANGES



- 402.2 Ceilings
- Deletes exceptions for cathedral & raised heel truss reductions in U-factor & UA
- 402.3 Windows/Doors
- Deletes exceptions for 15sf window/24sf door in U-factor & UA
- (AMD/CT) Sunrooms 402.2.11 envelope
- (AMD/CT) Sunroom U-Factor 402.3.5; no separate skylight U-
- (ADD/CT temp*) Moisture Control

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ATTIC OPENINGS - INSULATE & SEAL



- 402.2.3 Access hatches & doors
- Insulate per adjacent component
 - Weatherstrip
 - Protect insulation from damage
 - Contain insulation from displacement
- 402.4.1(10) Air Sealing rough openings

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AIR SEALING AND INSULATION 402.4.2



COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air penetrable insulation is not used as a sealing material. Air penetrable insulation is made of an air barrier.
Colligative	Air barriers in any deep cutting/bulbs in substantially aligned with insulation and any gaps are sealed. Air barriers in deep doors or deep door rain is sealed.
Walls	Connectors and brackets are installed. Junctions of foundation and sill plate is sealed.
Windows and doors	Gaps between window/door joints and framing is sealed.
Roof joints	Roof joints are sealed and include an air barrier.
Flashes	Insulation is installed to maintain permanent contact with underside of walkflue decking. Air barriers is installed at any exposed edge of insulation.
Ceiling space walls	Insulation is permanently attached to walls. Recessed walls in unconditioned spaces is covered with Class I vapor retarder with overlapping joints taped.
Shells penetration	Open shells, utility penetrations, knee walls and flat shells opening to exterior or unconditioned space are sealed.
Narrow cavities	Shells in narrow cavities are not to fit, or narrow cavities are filled by sprayed/blown insulation.
Garage separation	Air sealing is provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures are air tight, IC rated and sealed to drywall. IC-rated fixtures in conditioned space.
Punching and wiring	Insulation is placed between outside and pipes. Seal insulation is cut to fit around wiring and sheathing, or sprayed/blown insulation around behind pipes and wires.
Showers/bath on exterior wall	Showers and baths on exterior walls have insulation and an air barrier separating them from the exterior wall.
Electric/phone lines on exterior walls	Air barriers extend behind boxes or air sealed type boxes are installed.
Common wall	Air barrier is installed in common wall between dwelling units.
Dry AC register boxes	Dry AC register boxes that penetrate building envelope are sealed to walkflue or drywall.
Piercing	Piercing walls include an air barrier.

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AIR SEALING AND INSULATION



- 2 options to demonstrate compliance
 - When tested air leakage is <7 ACH when tested with a blower door at pressure of 33.5 psf (Section 402.4.2.1)
 - Testing after rough in and installation of building envelope penetrations
 - When items listed in Table 402.4.2, applicable to the method of construction, are field verified (Section 402.4.2.2)

Measuring Leaks - Blower Door Test

CFM x 60/CF of house. Air natural leakage (1/20 of test) should be expected between <0.70 (leaky) and >0.35 (tight).



FIREPLACES 402.4.3



- New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.



MECHANICAL & CONTROL SYSTEMS



- “Right-sized”
 - Better than NAECA
 - ACCA: S/J/D/T
- Tested
 - Ductwork
 - Balancing
 - Proper charge



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DUCT INSULATION & DUCT TESTING



403.2.1

- Supply in attic R-8
- All other R-6

403.2.2

- No insulation or test required inside conditioned space



(NEW) (Add) 403.2.1.1 Duct insulation values. Minimum duct insulation values stated in Section 403.2.1 shall be installed R-values.

- (NEW) (Amd) 403.2.3 Building cavities (Mandatory). Building framing cavities shall not be used as supply or return ducts.

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PIPE INSULATION 403.4



- 403.4 Circulating Systems (no change)

(NEW) (Add) 403.4.1 Pipe insulation. All service hot water piping within 10 feet of service water heating equipment shall be insulated to at least R-2. Systems with distribution manifolds shall be insulated between service water heating equipment and the distribution manifold or 10 feet, whichever is less. In addition, the first 5 feet of cold water pipes from the water heating tanks shall be insulated to at least R-2.

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LOADS - ACCA MANUALS J & S 403.6 SIZING / 403.7 MULTIPLES



- Ventilation
 - Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the system is not operating
- Equipment Sizing
 - CT references ACCA Manuals J & S
 - Load calculations determine the proper capacity (size) of equipment
 - Goal is big enough to ensure comfort but no bigger

(NEW) (Amd) 403.6 Equipment sizing (Mandatory). Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies.

ACCA SYSTEM DESIGN PROCESS

AGGREGATED LOADS FOR INDIVIDUAL SPACES

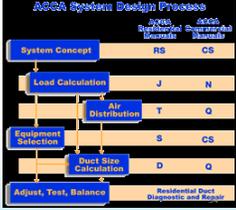
- **Sensible:** envelope, air leakage & exhaust, equipment, occupants & activities
- **Latent:** cooking, bathing, occupant, weather-related (A/C)

J. SYSTEM LOAD REQUIREMENTS

S. SELECTIONS OF EQUIPMENT

D. DELIVERY NETWORK SIZING

T. TESTING, LOAD BALANCING



SIMULATED PERFORMANCE 405

- Table 405.5.2(1) REVISED TO REFLECT CHANGES ABOVE
- 405.4.2 COMPLIANCE REPORT
 - Compliance based on simulated energy performance requires that a proposed residence (*proposed design*) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design*.



CHAPTER 5 SPECIFICS - 501.2 Use of ASHRAE 90.1 is exclusive

COMMERCIAL CHANGES

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TABLES - ENVELOPE COMPONENTS

- T502.1.2 Opaque
- R Use Group/"Other"
- T502.2(1) U-factor
- R Use Group/"Other"
- C-Factor
- F-Factor
- T502.2(2) Metal Frame
- Spacer blocks R-3.5 (1")
- T502.3 Fenestration
- No changes in Zone 5A
- Skylights combined - no separate glass/plastic

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NEW C- AND F-FACTORS

This separate U-factor Table is NEW in 2009

TABLE 502.1.2
BUILDING ENVELOPE REQUIREMENTS OF OPAQUE ELEMENT, MAXIMUM U-FACTORS

CLIMATE ZONE	5	
	All other ^a	Group R
	Roofs	
Insulation entirely above deck	U-0.045	U-0.045
Metal buildings	U-0.053	U-0.053
Attic and other	U-0.027	U-0.027
	Walls, Above Grade	
Mass	U-0.90	U-0.80
Metal building	U-0.069	U-0.069
Metal framed	U-0.064	U-0.064
Wood framed and other	U-0.054	U-0.043
	Walls, Below Grade	
Below-grade wall	C-0.119	C-0.119
	Floors	
Mass	U-0.074	U-0.064
Joist/Framing	U-0.033	U-0.033
	Slab-on-Grade Floors	
Unheated slabs	F-0.750	F-0.740
Heated slabs	F-0.850	F0.840

a. When heated slabs are placed below-grade, below-grade walls must meet the F-factor requirements for perimeter insulation according to the heated slab-on-grade construction.

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SECTION 503 BUILDING MECHANICAL SYSTEMS



Simplified to Include Only Four Sections:

- 1) What Provisions of the Code Apply (503.1)
- 2) Mandatory Provisions (503.2)
- 3) Simple HVAC Systems and Equipment (503.3)
- 4) Complex HVAC Systems and Equipment (503.4)



503.2 DUCTS & PIPES



- 503.2.7 Duct insulation
- CT amendment

(NEW) (Add) **503.2.7.2 Duct insulation values.** Minimum duct insulation values stated in Section 503.2.7 shall be installed R-values.

- 503.2.8 Piping insulation will have to be calculated for thickness if "k" factor of material is $>> 1.27/\text{inch}$

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OUTSIDE HEAT CONTROLS



503.2.11 Heating Outside a Building

- To be radiant heat systems only
- Controlled by an occupancy sensing device or timer switch
 - System is automatically de-energized when no occupants are present

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VENTILATION - DCV / ERV / FAN MOTORS

- 503.2.5.1 DCV



- 503.2.6 ERV

- 503.2.10 Air system fan HP & Operation

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DEMAND CONTROLLED VENTILATION (503.2.5.1)

- DCV must be provided for each zone with spaces > 500 ft² with the average occupant load > 40 people/1000 ft² of floor area where the HVAC system has:
 - An air-side economizer;
 - Automatic modulating control of the outdoor air damper; or
 - A design outdoor airflow > 3,000 cfm

Demand control ventilation (DCV): A ventilation system capability that provides for the automatic reduction of outdoor air intake below design rates when the actual occupancy of spaces served by the system is less than design occupancy.

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ECONOMIZERS - SIMPLE / COMPLEX

- 503.3.1(1) & Table - SIMPLE
- 503.4.1 (same table) - COMPLEX -different exceptions



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SUPPLY/RETURN DUCT AND PLENUM INSULATION AND SEALING (503.2.7)



- All ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with Section 603.9 of the IMC.



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SYSTEMS OPERATION & CONTROLS



- 503.4.3.3 Hydronic HPs
- 503.4.5.4 Supply air temperature resets
- 504.7 Pool heaters



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**HOT GAS BYPASS (503.4.7 - NEW)
(ERRATA CORRECTION - 502.4.4)**



- Don't use unless cooling system is designed with
 - multiple steps of unloading OR
 - Continuous capacity modulation
- Capacity limited per Table 503.4.7

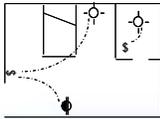
Rated Capacity	Maximum Hot Gas Bypass Capacity (% of total capacity)
≤ 240,000 Btu/h	50%
> 240,000 Btu/h	25%

- Exception to requirement:
 - Unitary packaged systems with cooling capacities < 90,000 Btu/h

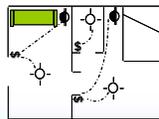
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505.2.3 R-1 UNIT MASTER SWITCHING

- Applies to hotels, motels, boarding houses, or similar
- Master switch required at each room or main room entry
- Must control all permanently wired luminaires or switched receptacles
 - Exceptions: bathrooms



Standard Room



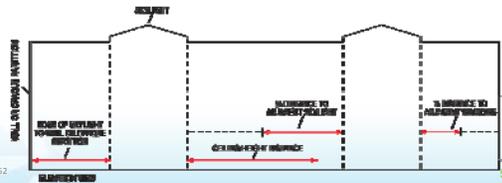
Suite

Intent: Allow occupant to turn off lights at exit point!

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DAYLIGHT ZONE DEFINITION - AT WINDOWS OR UNDER SKYLIGHTS

- The area under skylights whose horizontal dimension, in each direction, is equal to the skylight dimension plus the smaller of:
 - The floor-to-ceiling height, or
 - The distance to a ceiling height opaque partition, or
 - One-half the distance to adjacent skylights or windows



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DAYLIGHT ZONE CONTROL

- Daylight zones
 - Must have individual control of the lights independent of general area lighting
- Contiguous daylight zones adjacent to vertical fenestration
 - Can be controlled by a single controlling device if the zone doesn't include areas facing more than two adjacent cardinal orientations (i.e., north, east, south, west)
- Daylight zones under skylights > 15 ft from the perimeter must be controlled separately
- Exception: Daylight spaces
 1. enclosed by walls or ceiling height partitions and
 2. containing two or fewer light fixtures
 - not required to have a separate switch for general area lighting

Note: required controls may be manual or automatic

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EXTERIOR LIGHTING POWER LIMITS

(505.6.2)



What areas are covered under exterior lighting allowances?

- Tradable surfaces

Common exterior lighted needs that can be traded for other needs.

For example, wattage allowed for parking lot lighting can be "traded" and used for canopy lighting.



- Nontradable surfaces

Less common exterior lighted needs that **cannot** be traded for other needs.

These applications have more specific security or task illuminance needs.



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TRADABLE SURFACES



- Uncovered parking lots and areas
- Walkways (under/over 10 feet wide)
- Stairways
- Pedestrian tunnels
- Main building entrances
- Other doors
- Entry canopies
- Free-standing and attached sales canopies
- Open sales areas
- Street frontage sales areas



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NONTRADABLE SURFACES



- Building facades
- Automated teller machines and night depositories
- Entrances and gatehouse inspection stations at guarded facilities
- Loading areas for law enforcement, fire, ambulance and other emergency vehicles
- Drive-up windows/doors
- Parking near 24-hour retail entrances



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EXEMPTIONS FROM EXTERIOR CALCULATION (505.6.2)



The following lighting does not need to be included in the proposed lighting calculation:

- Specialized traffic signal, directional, and lane marker lighting
- Advertising signage or directional signage
- Lighting integral to *equipment* or instrumentation and installed by its *manufacturer*
- Lighting for theatrical purposes, including performance, stage, film production, and video production
- Lighting for athletic playing areas
- Temporary lighting
- Lighting for industrial production, material handling, transportation sites, and associated storage areas
- Theme elements in theme/amusement parks
- Lighting used to highlight features of public monuments and registered *historic* landmark structures or *buildings*



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CT 505.6.3 LIGHT POLLUTION CONTROLS



(NEW) (Add) 505.6.3 Light pollution controls. When the power for exterior lighting is supplied through the energy service to the building, luminaires used for exterior lighting shall be full cutoff luminaires.

Exceptions:

1. Luminaires with an output of 150 Watts incandescent or less, or the equivalent light output;
2. Luminaires intended to illuminate the facade of buildings or to illuminate other objects including, but not limited to, fountains, landscape and water features, statuary and works of art;
3. Luminaires for historic lighting on the premises of an historic building as defined in the 2003 International Existing Building Code or within a designated historic district;
4. Outdoor sports facility lighting of the participant sport area;
5. Emergency exit discharge lighting;
6. Low voltage landscape lighting;
7. Sign illumination;
8. Festoon lighting as defined in the 2005 NFPA 70 National Electrical Code; or
9. Temporary lighting for emergency, repair, construction, special events or similar activities.



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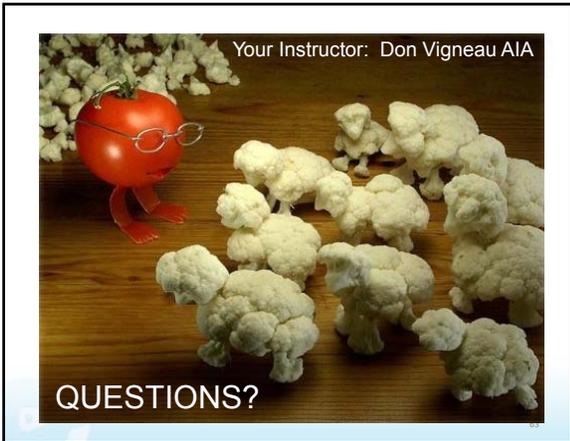
506 TOTAL BUILDING PERFORMANCE



- Revised to reflect changes described in Chapter 5 changes



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RESOURCES

Connecticut Light & Power
The Northeast Utilities System

CONNECTICUT ENERGY EFFICIENCY FUND
www.CEEFFund.com

ui
The United Illuminating Company

NEP

Northeast Utilities
<http://www.nu.com/>

Connecticut Light & Power Co.
<http://www.clp.com/>

United Illuminating Co.
<http://www.ui.com/>

THANK YOU
2009 ENERGY CODE CHANGES

DONALD VIGNEAU AIA
dvigneau@neep.org

Connecticut Design & Trades Conference
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5 Militia Drive Lexington, MA 02421
P: 781.860.9177 - x136
www.neep.org
