ENERGY CODE BASICS

PLAN REVIEWS AND FIELD INSPECTIONS

Donald J. Vigneau AIA
Northeast Energy Efficiency Partnerships
MISSION
Promote the efficient use of energy in homes, buildings and industry in the Northeast U.S.

ORGANIZATION
Regional nonprofit since 1996

PRIMARY AUDIENCES
• State policy makers
• Efficiency program administrators

APPROACH
Overcome barriers to efficiency through strategic regional collaboration of public policies and programs
WHAT DOES NEEP DO?

FACILITATE PARTNERSHIPS...

- High Efficiency Retail Products
- High Efficiency Home Performance
- High Efficiency Commercial Buildings and Technologies
- Workforce Development

- Policy Outreach
- Building Energy Codes
- High Performance School and Public Buildings
- Appliance Efficiency Standards

- Protocol Development
- Research and Evaluation
- Education and Information Access

- Conference
- Workshop
- Business Leadership
- Exhibition

TO ADVANCE THE EFFICIENT USE OF ENERGY EFFICIENCY
WHERE IS ENERGY HEADING?

• Zero Net Energy Buildings (ZNEB)
  – Energy Input = Energy Output
  (what’s produced on site equals what’s used)

THE TIMETABLE (DOE)

<table>
<thead>
<tr>
<th>2010</th>
<th>2015</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>30%</td>
<td>50%</td>
<td>3% per year ➔ ➔ ➔ 0%</td>
</tr>
</tbody>
</table>
WHAT’S IN IT FOR US

SAVING OUR ECONOMY FROM UNSUSTAINABLE VOLATILITY

Energy Security

- 1970 - last year U.S. exports oil
- 1973 - 1st oil embargo
- 1978 - 2nd oil embargo
- www.peakoil.org
A FIRM SET OF PRIORITIES

• CONSERVATION (NEGA-WATTS) - Use less energy
  – Prioritize space utilization: THINK SMALL
  – Re-use energy; recycle waste
• EFFICIENCY - Use most efficient equipment that does the job
  – Research your choices
  – Use the right tools: ACCA S/J/D/T, ASHRAE 183-07
  – TEST; COMMISSION to verify results

• THEN ADD RENEWABLES - More cost-effective here

• SUSTAINABILITY: not a separate priority;
  permeates each and every one of the issues above
• VERIFICATION: not a separate priority;
  needs to be a normal procedure that measures actual performance of systems
ENERGY SAVINGS STRATEGIES

**ELIMINATE**
- Unintended air leaks
- Voids, chases, chimneys
- Thermal bridging
- Attic ovens
- HVAC/SHW systems outside the envelope

**REDUCE**
- Uncontrolled Solar Gains
- Non-required Glazing*

**INNOVATE**
Control Layer Functions:
- Water Barriers
- Moisture Retarders
- Air Barriers
- Thermal Barriers
PLAN REVIEWS
BASIC REQUIREMENTS

USING ADMINISTRATIVE PROVISIONS
TO OBTAIN
NECESSARY INFORMATION
...IT’S IN THE CODE

IECC 103.2 Information.

Details shall include:
• Insulation materials/R-values
• Fenestration U-factors/SHGC’s
• System & equipment efficiencies,
• Types, sizes & controls
• Duct sealing, insulation & locations
• Air sealing details
BASIC CODE REQUIREMENTS

OTHER INFORMATION (meet mandatory requirements)

- RESCheck Compliance Report
- Energy Star Application w/information

SPECIAL REPORTS

- 3rd Party Inspectors
- Testing
• Code Official has final acceptance authority
  – Software, worksheets
  – Above Code Programs
• Electronic media can be used
• Construction work for which a permit is required is subject to inspection
• A certificate is required to be posted*
BASIC CODE REQUIREMENTS

GENERAL REQUIREMENTS - IECC 303

• Insulation Materials: Default R-Values/U-Factors

• Window & Door Default U-Factors (SHGC & VT)

CHAPTER 4

• Average Area-weighted U-Factors (maybe)

• HVAC & SHW Design information: sizing; equipment types

• Duct sealing/insulation
...IT’S IN THE CODE

401.3 CERTIFICATE

- PREDOMINANT R-VALUES
- U-FACTORS
- DUCT INSULATION
- HVAC & SHW EFFICIENCIES
- UNVENTED APPLIANCES
402.3.5 SUNROOM EXCEPTIONS

Less stringent insulation, R-value and glazing U-factor requirements - not changed in Chapter 5

Sunroom definition:
- Glazing area >40% glazing of combined gross exterior wall and roof area
- Separate heating or cooling system or zone (or none?)
- Must be thermally isolated (closeable doors or windows to the rest of the house)
USING LESS:
CONTROLLING THE ENVELOPE

Vigneau Residence
Mansfield Center CT
ENVELOPE: KEY CONTROL LAYERS

- WATER
- AIR
- WATER VAPOR
- THERMAL

www.buildingscience.com
CONTROLLING GAINS, LOSSES

HEAT GAIN
- Solar Heat Gain
- Shading / PF
- Attic ventilation

AIR MOVEMENT
- Make-Up Air Dampers
- Reduced Leakage

EXHAUSTS
- Baths
- Kitchens
- Laundry

MAKEUP AIR
- Combustion Eqp’t.
- Fireplaces
- Central Vac
THE PERFECT WALL

HOW IT WORKS

• Uses thermal breaks

• Controls temperature

• Controls humidity

• Controls air - Relies on ventilation systems

THE SANDWICH

• Outside Cladding
  – Imperfect Weather Barrier

• Control Layers
  – Rain*
  – Air
  – Vapor*
  – Thermal

• Structure - Why here?

• Interior Finish
WHAT DOES IT LOOK LIKE?

“OUT-SULATION”
• Insulates the structure
• Provides/protects:
  – Drainage plane
  – Air barrier
  – Vapor retarder

The Perfect Wall functions
• as the Perfect Roof (over the structure)
• as the Perfect Floor (under the slab)
LEARNING HOW TO BUILD IT
IRC SECTION R601.3 - 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;
2009 IECC introduces 3 classes of vapor retarders:

I. 0.10 perm or less
II. 0.10 – 1.00 perm
III. 1.00 – 10.0 perm
## MOISTURE DIFFUSION IN MATERIALS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>PERM RATING</th>
<th>VAPOR RETARDER(?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>½” GWB</td>
<td>38 -42</td>
<td>NO</td>
</tr>
<tr>
<td>TYVEK</td>
<td>52</td>
<td>NO</td>
</tr>
<tr>
<td>Latex Primer</td>
<td>7.0 – 10.0</td>
<td>NO</td>
</tr>
<tr>
<td>7/16” OSB (w/ exterior glue)*</td>
<td>0.77* – 3.48</td>
<td>SOMETIMES</td>
</tr>
<tr>
<td>1” XPS</td>
<td>0.40 – 1.60</td>
<td>SOMETIMES</td>
</tr>
<tr>
<td>7/16” Plywood (exterior glue)</td>
<td>0.70</td>
<td>YES</td>
</tr>
<tr>
<td>Kraft Paper Facing</td>
<td>1.0</td>
<td>YES</td>
</tr>
<tr>
<td>2 mil polyethylene</td>
<td>0.06 – 0.22</td>
<td>YES</td>
</tr>
<tr>
<td>Alkyd-base or V/R paint</td>
<td>&lt; 0.05</td>
<td>YES</td>
</tr>
<tr>
<td>1 mil aluminum foil laminate</td>
<td>&lt; 0.05</td>
<td>YES</td>
</tr>
<tr>
<td>½” GWB + VWC</td>
<td>0.05 – 0.80</td>
<td>YES</td>
</tr>
</tbody>
</table>
HOW TO CONTROL VAPOR (MOISTURE)

Control the Leaks

Air leaking into the house
Air leaking out of the house
POP QUIZ:

IS WATER VAPOR...

LIGHTER THAN AIR?

HEAVIER THAN AIR?

THE SAME?

Does it matter?

(TONIC)
...ANY QUESTIONS?
402.2.7 SLAB EDGE INSULATION

- R-10 (typically 2 inches) insulation in Zones 4 and above; *Note ‘d’ requires 5” more for heated slabs*
- Downward from top of slab a minimum of 24” (Zones 4 and 5) or 48” (Zones 6, 7, and 8)
- Insulation can be vertical or extend horizontally under the slab or out from the building (must be under 10 inches of soil)
INSULATION - VAPOR RETARDER

CONVENTIONAL

• Full cavity R-20; face stapled
• Fitted at boxes
• Class 1 V/R warm side
• Air barrier at exterior

BEST PRACTICES

• Use R-601.3/Tbl.601.3.
  – R 5 on 2x4; R 7.5 on 2x6
• Midpoint air/VR barrier
1998 AIRTIGHT STUDY

SINGLE FAMILY - ACH

- Mean Age: 20-30yr
- Tight: 0.19-0.24
- Good: 0.48-0.59
- Typical: 0.96-1.18
- Leaky: 1.93-2.35

- Canada: 0.11+
- ASHRAE 62 min 0.35

MOISTURE MIGRATION PRIORITIES
Significantly more water vapor travels through a wall by air leakage than by diffusion
HOW TO DO IT?
CONTROLLING VENTILATION

Core: Heat Recovery Units feature a lifetime warranty on the aluminum core.

Washable Electrostatic Filters

Fully Insulated Cabinet:
Baked powder-coat finish. Insulated with 1" (25mm) foil-faced, high density polystyrene foam. For quiet, trouble-free operation.

Superior EBM Motors: Units are designed with German manufactured EBM external rotor motorized impellers – the most durable motors in the industry. Precise balancing ensures vibration-free operation. No maintenance needed. 7 Year Limited Warranty.

Electronic Control Board:
Units feature state-of-the-art control boards for easy connection to existing HVAC equipment. All units are designed for easy operation from a series of optional remote controls.
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).
CONTROLLING FENESTRATION

- WINDOWS
- SKYLIGHTS
- DOORS
FENESTRATION PERFORMANCE

- **NFRC Ratings**
  - NFRC 100, *U*-factors
  - NFRC 200, SHGC
  - Windows, doors, skylights
- **Default *U*-factors & SHGC’s**
- **Manufactured fenestration**
  - Standardized infiltration rates
  - AAMA/WDMA I.S.2, or
  - NFRC 400
- **“Site-built” fenestration**
  - Caulk, gasket or weather-strip for infiltration control
RE-RADIATION: LOW - E

Inside Glass Surface Temperature (deg F)

<table>
<thead>
<tr>
<th>U</th>
<th>20° outdoors</th>
<th>0° outdoors</th>
</tr>
</thead>
<tbody>
<tr>
<td>single clear</td>
<td>1.04</td>
<td></td>
</tr>
<tr>
<td>double clear</td>
<td>0.57</td>
<td></td>
</tr>
<tr>
<td>double low-E (low solar gain) argon gas</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td>quad 2 low-E (moderate solar gain) krypton gas</td>
<td>0.28</td>
<td></td>
</tr>
</tbody>
</table>

http://www.efficientwindows.org/selection.cfm
CORRELATION: Low E and SHGC

**LOW ‘E’**

- VLT transparent
- Reflects primarily infrared
- Pyrolitic coating
- May be sputtered

**SHGC**

- Reduces VLT
- Reflects more energy
- Sputter coat ‘silvered’
- May be film or tint
LOCATIONS WITH SHGC REQUIREMENTS

0.40 SHGC

Hood awning
Venetian awning
Exterior roll blind
Thermal Bypass Checklists

VENTILATION

• Kitchens & bathrooms
• Limiting exhaust CFM*
• Clothes dryers vent outside
• Air inlet/exhaust locations

• Ventilation controls
• MERV filtration required*
• Limitations on fan noise*
• NO vent-less combustion*
• CO detector for fueled* appliances
WATER MANAGEMENT

• Slope patios, walks, grades
• Slab capillary breaks
• Damp-proof foundation walls
• Gasket sump drain covers

• Cover foundation drains
• Flash base of exterior wall
• Drainage plane - outward
• Roof/window/door flashings
• Backer board tubs & showers
MECHANICAL & ELECTRICAL SYSTEMS

WHERE EFFICIENCY MATTERS
SELECT

HVAC EQUIPMENT

• Energy Star qualified

• Right-sized *(15-40%)*
  (see 2012 EC-121)

Service Hot Water
MECHANICAL & CONTROL SYSTEMS

• “Right-sized“
  – Better than NAECA
  – ACCA:  S/J/D/T

• Tested
  – Ductwork
  – Balancing
  – Proper charge

• Commissioned*
  – Post-occupancy (C.O.)
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)

SYSTEM LOAD REQUIREMENTS

SELECTIONS OF EQUIPMENT

DELIVERY NETWORK SIZING

TESTING, LOAD BALANCING
DESIGN ISSUES

• Exposure, orientation
  – Latitude, altitude
• Large glazing areas
  – NFRC compatible
  – Glazing orientations
• Solariums
• Shading devices
• Internal loads

CONSTRUCTION ISSUES

• Gains/losses for many materials systems
• Roofing color, loads
• Duct loads
• Infiltration loads
• Internal loads
VENTILATION AND EQUIPMENT SIZING

• Ventilation
  – Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating

• Equipment Sizing
  – IECC references Section M1401.3 of the IRC
  – Load calculations determine the proper capacity (size) of equipment
    • Goal is big enough to ensure comfort but no bigger
  – Calculations shall be performed in accordance with ACCA Manual J or other approved methods
## CHAPTER 5 - EQUIPMENT SIZING

<table>
<thead>
<tr>
<th>UNIT</th>
<th>MAXIMUM OVERSIZING PERCENTAGE</th>
<th>MINIMUM EFFICIENCY AND TESTING PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Conditioners</td>
<td>15%</td>
<td>Table 503.2.3(1)</td>
</tr>
<tr>
<td>Multi-speed Air Source Heat pumps &amp; GSHP</td>
<td>15%</td>
<td>Table 503.2.3(2)</td>
</tr>
<tr>
<td>Single-speed GSHP</td>
<td>25%</td>
<td>Tables 503.2.3(2) or (3)</td>
</tr>
<tr>
<td>All fuel-fired heating appliances</td>
<td>40%</td>
<td>Tables 503.2.3(4) or (5)</td>
</tr>
</tbody>
</table>
Thermal Bypass Checklists

EQUIPMENT

• Design, spec, document
• Ducts - ACCA “D”
• Duct Terminals - ACCA “T”
• Design Loads - ACCA “J”
• Equipment specs - ACCA “S”
• ARI condenser/evaporator
• Drain pan to plumbing trap
• LIGHTING (N1104)
Thermal Bypass Checklists

FIELD VERIFY EQUIPMENT:

- Heat gains - latent/sensible
- Air flows/static pressures
- Fan motor - type, speed
- Refrigerant type/charge
- Refrigerant metering devices
- Return/supply air temps.
- Outdoor ambient temp.
- Line pressures/temps.
MECHANICAL & ELECTRICAL SYSTEMS

NOT THIS WAY!

POORLY CUT INSULATION EXPOSES JOINT TO COLD

HOT OR COLD WATER PIPE
R-3 INSULATION OUTSIDE CONDITIONED SPACE

PIPE INSULATION

CAREFULLY CUT INSULATION FOR TIGHT MITER FIT
SECURE CORNER CUTS WITH TAPE OR GLUE
THINKING OUTSIDE THE BOX

SERVICE WATER EFFICIENCY
RE-THINKING WATER USAGE

**DESIGN**

- Centralize Functions
- Compact Layout
- “Right Size” piping*
- Insulate HW lines

**SYSTEM FEATURES**

- Minimize MANIFOLDS
- Make more “TWIGS”
- Shut off CIRCULATORS
- Reduce SOURCE TEMPS*
Traditional Trunk System

More Efficient Manifold System

SERVCE HOT WATER EFFICIENCY
INSPECTIONS

What Are We Looking For?

When Should We Be Looking For It?
A RESCHECK REPORT

RESCheck Software Version 4.3.1
Inspection Checklist

Ceilings:
- Ceiling 1: Cathedral Ceiling (no attic), R-0 (uninsulated)
  Comments: Sloped ceilings in 2nd Floor bedrooms, bath & hall
- Ceiling 2: Flat Ceiling or Soffit Truss, R-0 (uninsulated)
  Comments: Flat ceiling portion, 2nd Floor
- Ceiling 3: Flat Ceiling or Soffit Truss, R-0 (uninsulated)
  Comments: Ceiling of 1st Floor
- Ceiling 4: Other, U-factor: 0.599
  Comments: Insulate under stairs to 2nd floor

Above-Grade Walls:
- Wall 1: Wood Frame, 24" o.c., R-0 (uninsulated)
  Comments: North Wall 1st Floor - FRONT
- Wall 2: Wood Frame, 24" o.c., R-0 (uninsulated)
  Comments: East Wall 1st Floor
- Wall 3: Wood Frame, 24" o.c., R-0 (uninsulated)
  Comments: East Wall 2nd Floor - lower
- Wall 4: Wood Frame, 24" o.c., R-0 (uninsulated)
  Comments: East Wall 2nd Floor - upper
- Wall 5: Wood Frame, 24" o.c., R-0 (uninsulated)
  Comments: South Wall 1st Floor - REAR
- Wall 6: Wood Frame, 24" o.c., R-0 (uninsulated)
  Comments: West Wall 1st Floor - lower
- Wall 7: Wood Frame, 24" o.c., R-0 (uninsulated)
  Comments: West Wall 2nd Floor - upper
- Wall 8: Wood Frame, 16" o.c., R-0 (uninsulated)
  Comments: 1/2 x 2 stair walls to unconditioned basement

Windows:
- Window: Kitchen Vinyl Frame, Double Pane with Low-E, U-factor: 0.290
  For windows without labeled U-factors, describe features:

Compliance Certificate

Project Title: MBOIA TEST HOME

Energy Code: 2009 IECC
Location: Lewiston, Maine
Construction Type: Single Family
Conditioned Floor Area: 1500 ft^2
Glazing Area Percentage: 10%
Heating Degree Days: 7244
Climate Zone: 6

Construction Site: ANYWHERE STREET
Owner/Agent: DONALD WIGNEAU
Designer/Contractor: NEEP
91 HARTWELL AVE
LEXINGTON, MA 02421
781-860-9177 eXT.136
dwignneau@neep.org

Compliance: Wall orientation not specified

<table>
<thead>
<tr>
<th>Assembly</th>
<th>Gross Area or Perimeter</th>
<th>Cavity R-Value</th>
<th>Cont. R-Value</th>
<th>Glazing or Door U-Factor</th>
<th>UA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceiling 1: Cathedral Ceiling (no attic)</td>
<td>317</td>
<td>0.0</td>
<td>0.0</td>
<td>0.350</td>
<td>2</td>
</tr>
<tr>
<td>Skylight: 2 Bath: Wood Frame, Double Pane with Low-E</td>
<td>6</td>
<td>0.47</td>
<td>0.350</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Ceiling 2: Flat Ceiling or Soffit Truss</td>
<td>388</td>
<td>0.0</td>
<td>0.0</td>
<td>0.350</td>
<td>2</td>
</tr>
<tr>
<td>Ceiling 3: Flat Ceiling or Soffit Truss</td>
<td>442</td>
<td>0.0</td>
<td>0.0</td>
<td>0.350</td>
<td>251</td>
</tr>
<tr>
<td>Ceiling 4: Other</td>
<td>50</td>
<td>0.0</td>
<td>0.0</td>
<td>0.350</td>
<td>30</td>
</tr>
<tr>
<td>Wall 1: Wood Frame, 24&quot; o.c.</td>
<td>340</td>
<td>0.0</td>
<td>0.0</td>
<td>0.350</td>
<td>66</td>
</tr>
<tr>
<td>Wall 1: Wood Frame, 24&quot; o.c. Orientation: Front</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Window: Kitchen: Vinyl Frame, Double Pane with Low-E</td>
<td>14</td>
<td>0.40</td>
<td>0.290</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Window: Bath: Vinyl Frame, Double Pane with Low-E</td>
<td>14</td>
<td>0.40</td>
<td>0.290</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Window: Entry: Vinyl Frame, Double Pane with Low-E</td>
<td>7</td>
<td>0.40</td>
<td>0.290</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
INSPECTING FOUNDATIONS

FOR NOW
• Sill sealer under sill plates
• Dampproofing
• Exterior foundation insulation

FOR LATER
• Slab edge insulation
• Under-slab EPS/XPS
ROUGH FRAMING / ROUGH-INS*

CONVENTIONAL

• Air Sealing Table 402.4.2 (but see EC-25 FAH)
• Openings/holes
• Caulking/foam

ENERGY STAR etc.

• Insulation location(s)
• Taped sheathing
• Drainage plane

*How do you resolve split jurisdiction inspections?
AIR LEAKAGE INSPECTIONS 402.4.1

- Joints, seams, other penetrations
- Dropped ceilings
- Between sole plates
- Behind tubs, showers
- Floors/exterior walls - unconditioned space
- Plumbing/Electrical utility penetrations
- Service access doors or hatches
- AROUND PENETRATIONS
OTHER AREAS

POSITIVE PRESSURE: MOIST INDOOR AIR LEAKS INTO CAVITIES (POTENTIAL MOISTURE PROBLEM)

MOISTURE CONDENSES ON COLD SURFACES

EXTERIOR SIDING

SHEATHING

OUTLET BOX

INSULATION

INTERIOR WALL COVERING

NEGATIVE PRESSURE (EXHAUST VENTILATION): DRY OUTDOOR AIR LEAKING IN PREVENTS MOIST INDOOR AIR FROM LEAKING OUT (PREVENTS MOISTURE PROBLEMS)

MOISTURE NOT PRESENT, NO CONDENSATION

EXTERIOR SIDING

SHEATHING

OUTLET BOX

INSULATION

INTERIOR WALL COVERING

Knee wall door

Add R-value to the knee-wall door, by adhering rigid insulation board (sandwiched together with construction adhesive and screws) to the back of the door. The clearance between the insulation and the door frame as well as air sealing details will require special attention.
INSULATION INSPECTIONS
ANYTHING WRONG HERE?

photo by Britt-Makela Group
EQUIPMENT / APPLIANCES

CONVENTIONAL
• Gravity Venting
• Power Venting
• Combustion air (leaks)

ENERGY STAR etc.
• Direct Venting
• Fuel-fired direct vent
• Insulating lines
THERMOSTAT CONTROLS 403.1.1

- One per dwelling for forced air required
- Programmable
- Heat/AC or HVAC
- Deadband $\geq 5^\circ F$
- One per ZONE really needed, but not code
SECTION 403.2
DUCT EFFICIENCY -
BY TESTING

6 cfm/100sf w/air handler
4 cfm WITHOUT (0.1” w.g.)
Exterior Grounds Lighting and Specific Technologies

System Efficacy (Lumens/Watt)

System Watts

High Pressure Sodium
Metal Halide
Fluorescent
Incandescent

Not Allowed

50 % interior residential*
THANK YOU
PLAN REVIEWS AND FIELD INSPECTIONS

DONALD VIGNEAU AIA
dvigneau@neep.org

Massachusetts Building Commissioners
and Inspectors Association
OCTOBER 23, 2010

5 Militia Drive   Lexington, MA 02421
P: 781.860.9177
www.neep.org
NEW RESIDENTIAL

- Energy Star 2.0 based*
- Prescriptive Option
- RESNET performance

NEW COMMERCIAL

- NBI & ASHRAE based
- Prescriptive/Performance
- Commissioning measures
ENERGY STAR

A 120.AA REQUIREMENT
Thermal Bypass Checklists

WALLS - “O.V.E.” FRAMING
- Minimize framing
  - Two-stud corners
  - Insulated headers
  - Single jacks or hangers
  - 24” stud/floor/truss alignments
  - Envelope/partition intersections sealed/insulated

High Performance DEFINITION:
- Insulated sheathing OR
- Structural insulated panels OR
- Insulated concrete walls OR
- Double wall framing
Thermal Bypass Checklists

**THERMAL BYPASS**

- Overall Barrier Alignment
- Wall envelope interfaces
- Floor envelope interfaces
- Attic/ceiling interfaces
- Shafts; utility penetrations
- Attic/ceiling interfaces

**FRAMING FEATURES - ATTIC**

- Trusses - raised heel
- Raised equipment platform

**NO FREEBIES**

- No free window/door/ceilings
NEW RESIDENTIAL COMPLIANCE

BASED ON:

• 120AA Chapter 1; IECC 2009 Chapter 4
• ENERGY STAR Thermal Bypass Checklists
• HERS Rating Index for the dwelling -
  • 65 for > 3,000 sf (greater than)
  • 70 for < 3,000 sf  (less than)

H.E.R.S. is based on the 2004 IRC

• NOT IRC
RESIDENTIAL RENOVATIONS COMPLIANCE

AFFECTED ENVELOPE PORTIONS:

- Meet/exceed IECC 2009, OR
- Fully fill cavities (R-3.7 minimum)
  
  OR
- Use ENERGY STAR Checklists w/
  - HERS Performance Option
    - 85 for < 2,000 sf (less than)
    - 80 for > 2,000 sf (greater than)
- Exceptions:
  - Construction not disturbed
  - Sash repairs

H.E.R.S. changing in 2011

NOT IRC
404.7 H.E.R.S. COMPLIANCE OPTION

- The Home Rating Energy System (HERS) is an optional path to compliance
SOLVING PROBLEMS

Do we address:

• The SYMPTOM
  or
• The CAUSE
QUESTIONS
<table>
<thead>
<tr>
<th>YEAR</th>
<th>CO₂ (PPM)</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>387.35</td>
<td>COPENHAGEN ACCORD</td>
</tr>
<tr>
<td>2008</td>
<td>385.57</td>
<td>THE LATEST YEAR FOR WHICH A FULL YEAR OF DATA IS AVAILABLE</td>
</tr>
<tr>
<td>2007</td>
<td>383.71</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>381.85</td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td>363.47</td>
<td>Kyoto Protocol</td>
</tr>
<tr>
<td>1992</td>
<td>356.27</td>
<td>Earth Summit in Rio de Janeiro</td>
</tr>
<tr>
<td>1987</td>
<td>348.98</td>
<td>The last year in which the annual CO₂ data was less than 350 ppm</td>
</tr>
<tr>
<td>1959</td>
<td>315.98</td>
<td>The first year for which a full year of precise instrument data is available</td>
</tr>
</tbody>
</table>
HOW DO WE GET THERE - USE GLOBAL THINKING

• SOURCE ENERGY: Extract, process, store, modify, use; re-use; dispose of; all in a controlled/managed way; as opposed to water, lightning, wind, fire, geothermal that we can capture, and manage to exert some control over.

• CONTROL/MANAGE/FIND THE NEGAWATTS

• “The cheapest BTU is one you never have to use”

• What don’t I understand about energy?

• What makes energy efficiency visible?