WELCOME!

Workshop Sponsors

Western Massachusetts Electric | nationalgrid | NSTAR

Supporters

Home Builders Association of Western MA

Town of Belchertown, Town of Lenox

Western Massachusetts Chapter of the AIA
PeoplesBank, F.W.Webb, Northampton

S&A Supply, Ed Herringtons Inc.

MCC

CET Initiatives

Renewable Energy & Green Building

Energy Efficiency Programs

Environmental Education

Recycling and Waste Management

CET

Requirements of the Massachusetts Residential Energy Code

Jay Walsh
Energy Analyst and Certified Home Energy Rater
Center for Ecological Technology

Belchertown MA 3-25-08
Lenox MA 4-23-08

CET
www.cetonline.org

MCC

Massachusetts Residential Building Code 7th Edition

- Chapter 61 is the Energy Efficiency section
- Became effective January 1, 2008

CET

Requirements of the 7th Edition

- Properly sealed ductwork with approved tapes or mastic.
- Properly sized heating and cooling systems
- Reduce air leakage
  (Sealing holes, gaps, seams, and penetrations in the building envelope)
- Properly installed insulation

@CET 5

Ducts Sealed with Mastic

Required by MA Energy Code

- Nationwide duct leakage is estimated to be 20-30%.
- Ducts sealed with mastic can reduce leakage to 10% and below
- Reduced energy costs
- Reduced indoor air pollution

@CET 6

@CET 7

@CET 8

©CET 9

Unsealed ducts like these can:

- Transport contaminants from garage, cellar, and crawl spaces
- Cause comfort issues

©CET 11

Joist Panning of returns should be avoided when possible.

--- Can't be insulated

--- almost impossible to seal properly

--- can lead to mold growth

©CET 10

Ducts Sealed right . . . . .

Sweet!

©CET 12

The Impact of Duct Sealing

18% Duct Leakage

Reduced to 6%

= almost 900 lbs CO2

Heating/Cooling Load Calculations

- Properly sized equipment saves money
- Provides better dehumidification
- Greater comfort
- More efficient – lower pollutants
- Longer equipment life

For calculation, use

- ACCA Manuals J
- ASHRAE Handbook of Fundamentals, or
- Other procedure approved by BBRS

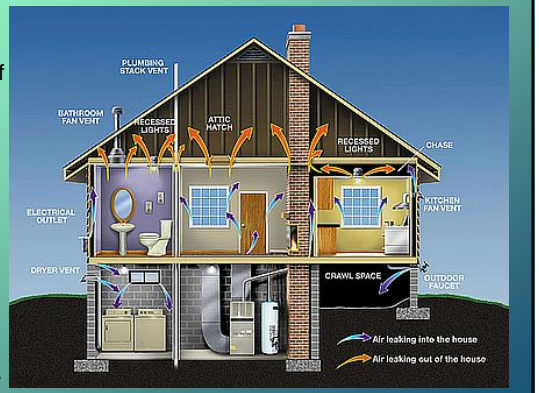
Heating and Cooling Load Calculations *per MA Energy Code*

- Performed by HVAC contractor
- Submitted to Building Inspector with permit application

  OR
- Before system is installed.

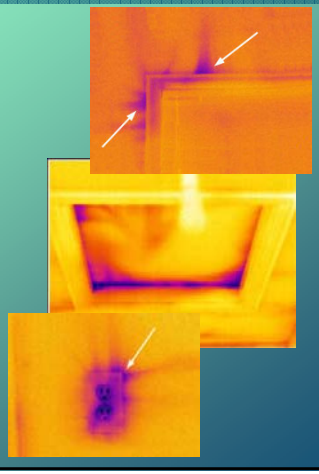
Air Sealing of Envelope

- Air Leakage (Infiltration) can account for 15% of the homes heat loss.
- Air leakage transports moisture into the building shell.
- Moisture in the shell results in mold growth and deterioration of building materials.



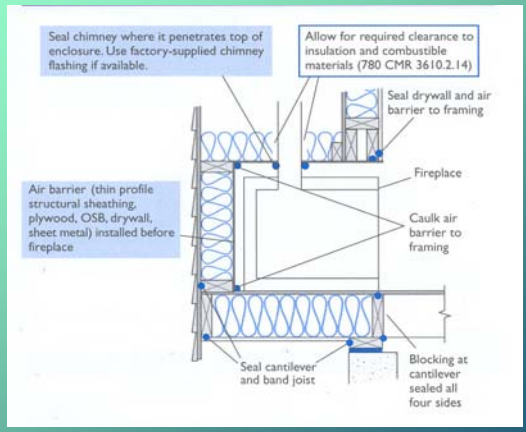
Air Sealing of Envelope

- Around Door and Windows
- Attic Hatch
- Wall Outlets



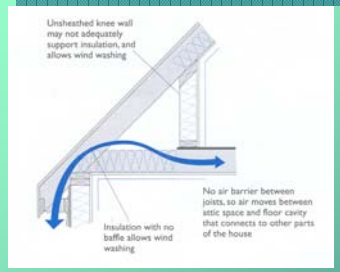
CET

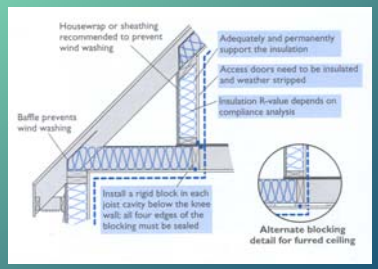
Proper Installation of Insulation



CET

Proper Installation of Insulation





CET

Proper Installation of Insulation

- Insulation and rigid air barrier behind tubs and showers
- Baffles (proper vents) at soffits to prevent wind washing.
- Floor insulation in full contact with sub floor (air barrier).
- Under Slab insulation and Slab Edge insulation for on-grade and walk-out basements.

CET

Green Building with CET

3rd Party Inspection and Verification for ENERGY STAR for New Construction

3rd Party Inspection and Verification for US Green Building Council LEED for HOMES

CET

Center for Ecological Technology
Green Building Consulting,
Green Audit for Existing Homes
Energy Audit & Weatherization Programs
ReStore Home Improvement Center

Building Green Benefits to Builders and Homebuyers

- Reduction in materials used
- Lower energy and water bills
- Reduction in waste to landfills
- Superior end product
- Third party verification and testing
- Reduced impact on the environment
- Use of environmentally preferable products
- Reduced greenhouse gas emissions
- Competitive edge for sales and resale

Building Green Benefit

Overall reduced impact on environment

US Green Building Councils LEED for HOMES Checklist

The LEED-H Checklist is used to determine the level of environmental impact of the homes construction.

A home can achieve a rating of:
Certified
Silver
Gold
Platinum

LEED for HOMES Checklist

Checklist Categories

- Innovation & Design
- Location & Linkages
- Sustainable Sites
- Water Efficiency
- Energy & Atmosphere
- Materials & Resources
- Indoor Environmental Quality
- Awareness and Education

Possible 130 points total

CET

25

Innovation & Design

Creative, Innovative, Ideas

Methods, Materials, Reuse, Reduce

CET

27

Green Home Example

LEED Checklist

Seeking LEED **GOLD** **87**

• Innovation & Design	4 / 9
• Location & Linkages	3 / 10
• Sustainable Sites	11 / 21
• Water Efficiency	5 / 15
• Energy & Atmosphere	38 / 38
• Materials & Resources	9 / 14
• Indoor Environmental Quality	16 / 20
• Awareness and Education	1 / 3

4,190 Sq Ft - 4 Bedroom - 4 Bath

CET

26

Innovation & Design

Creative, Innovative, Ideas

Methods, Materials, Reuse, Reduce

CET

28

Innovation & Design

DURABILITY PLAN

Assess - Environmental Risks

- Exterior Moisture
- Interior Moisture
- Radon
- Solar Radiation
- Pest Control
- Natural Disasters

Develop and Implement construction strategies to deal with these risks.

Location & Linkages

Consider placement of homes in socially and environmentally responsible ways in relationship to the larger community

Sustainable Sites

Site Stewardship

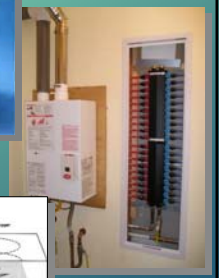
- Involve landscape design early
- Minimize disturbance to site
- Maintain Erosion Controls
- Identify and protect trees
- Avoid invasive plant species
- Consider the sites solar potential

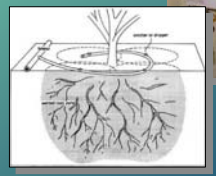
Invasive Plants

Erosion Controls

Water Efficiency

- High Efficiency Fixtures
  - Toilets (≤1.3 GPF)
  - Showers & Faucets (≤2.0 GPM)
- Rainwater Harvesting System
- Grey Water Re-Use System
- Efficient Water Distribution
- Efficient Irrigation System
- Design Landscape for Minimal Water Use





Energy & Atmosphere

January 2008

$100 - Barrel

August 2004

$50 - Barrel

CET

Energy & Atmosphere

January 2008

~~$100 - Barrel~~

April 15th 2008

$114 - Barrel

August 2004

$50 - Barrel

CET

Energy & Atmosphere

January 2008

~~$100 - Barrel~~

April 15th 2008

~~$114 - Barrel~~

April 30th 2008

$120 - Barrel

August 2004

$50 - Barrel

CET

Energy & Atmosphere

January 2008

~~$100 - Barrel~~

April 15th 2008

~~$114 - Barrel~~

April 30th 2008

~~$120 - Barrel~~

May 10th 2008

$125 - Barrel

August 2004

$50 - Barrel

CET

Energy & Atmosphere

August 2004

$50 - Barrel

January 2008
~~$100 - Barrel~~
April 15th 2008
~~$114 - Barrel~~
April 30th 2008
~~$120 - Barrel~~
May 10th 2008
~~$125 - Barrel~~
May 15th 2008
$132 - Barrel

@CET

Energy & Atmosphere

April 30th 2008

OPEC President states

"Oil Prices likely to hit $200 a Barrel"

@CET

Energy & Atmosphere

August 2004

$50 - Barrel

January 2008
~~$100 - Barrel~~
April 15th 2008
~~$114 - Barrel~~
April 30th 2008
~~$120 - Barrel~~
May 10th 2008
~~$125 - Barrel~~
May 15th 2008
~~$132 - Barrel~~
May 21st 2008
$134 - Barrel

@CET

Energy & Atmosphere

2007	– 2008
Crude Oil	+51.5% $/Barrel
Gasoline	+25.4% $/Gal
Diesel	+36.6% $/Gal
Heating Oil	+35.0% $/Gal
Natural Gas	+10.7% $/Mcf

@CET

Energy & Atmosphere

@CET

41

ENERGY STAR Participation

- Submit plans & Specs for review
- Pre Drywall & Thermal Bypass Inspection
- Final Inspection
  - Blower door test
  - Duct tightness testing
  - Ventilation testing
  - Equipment verification
- Get ENERGY STAR label

lower energy bills

@CET

42

High performance insulation

Loose & Dense Pack Cellulose

Open-Cell & Closed-Cell Foam

Kraft Faced Fiberglass Batts

Friction Fit Fiberglass With Vapor Barrier

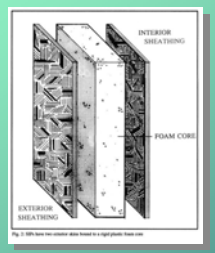
@CET

43

High performance insulation

ICF's Insulated Concrete Forms

Recycled Blue Jean Insulation



SIP's Structural Insulated Panels

Mineral Wool
- Rock Wool
- Slag Wool

@CET

44

High performance equipment

HEATING

Boilers	AFUE 90%+
Forced Air Furnaces	AFUE 90%+
Heat Pump	COP 3.0+

COOLING

Central Air	SEER 13+
Heat Pump	EER 14+

- Efficient system for domestic hot water heating
- Energy Star Appliances
- Efficient fan motors
- High Efficiency Lighting

ENERGY STAR

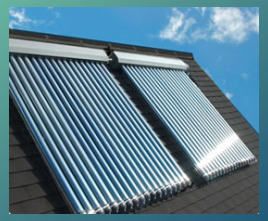
CET

45

Renewable Energy Systems: *Reduce Fossil Fuel Usage*

Electricity Generation

Heating Domestic Hot Water



CET

47

Tighter building envelopes

Follow Energy Star Thermal Bypass details

Select High Performance Windows U=0.35 or lower

Establish a home Ventilation Strategy

Play close attention to Air Sealing

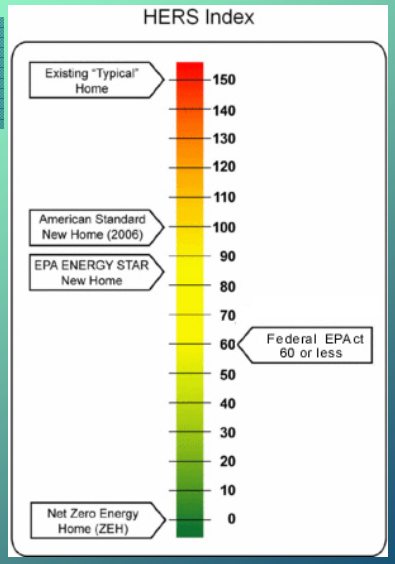
CET

46

Energy Star HERS Index

Home Energy Rating System

From 100 – Zero in 5 Minutes



CET

48

Energy Star Index 85

4,120 Sq Ft - 4 Bedroom - 4 Bath

ENERGY STAR	
INDEX	85
• Orientation	South
• Walls Fiberglass 2x6 @ 16 o.c.	R 19
• Ceilings Fiberglass	R 30
• Double Pane Windows	U 0.36
• Heating Boiler oil	85% AFUE
• Basement Insulated R10	Unheated
• Hot Water Intergraded 40gal	EF .78
• Infiltration - Air Change per Hour	0.40
• Compact Fluorescent Lighting	10%
• Energy Star Appliances	100%

CET

Energy Star/LEED Net Zero Home

4,190 Sq Ft - 4 Bedroom - 4 Bath

Net Zero Energy Home
Enrolled in LEED for Homes with CET

ENERGY STAR	
INDEX	0
• Orientation	South
• Walls ICF Construction	R 22
• Ceilings 10“ Icynene R 3.6 /inch	R 36
• Triple Pane Windows	U 0.19
• Heating/Cooling GSHP	COP 4.0
• Hot Water GSHP Assisted 50gal	EF 1.30
• Solar PV 1,000 S.F.	15 kW
• Infiltration - Air Change per Hour	0.09
• Compact Fluorescent Lighting	100%
• Energy Star Appliances	100%
• HRV and Air-Handler	ECM Motors

CET

Energy Star Index 60 = (EPAct)

4,200 Sq Ft - 4 Bedroom - 4 Bath

ENERGY STAR	
INDEX	60
• Orientation	South
• Walls 3” High Density Foam	R 20
• Ceilings 10” Cellulose	R 37
• Double Pane Windows	U 0.32
• Heating Hydro-Air LP	92% AFUE
• Cooling Central	SEER 13
• Hot Water Intergraded 50gal	EF .85
• Infiltration - Air Change per Hour	0.25
• Compact Fluorescent Lighting	25%
• Energy Star Appliances	100%
• HRV and Air-Handler	ECM Motors

CET

Materials & Resources

Material Efficient Framing

Environmentally Preferable Products

Waste Management

CET

52

Materials Efficient Framing

Also referred to as Optimum Value Engineering (OVE)

Exhibit MR 1-B
List of Advanced Framing Measures
for MR Credit 1.2

Efficient Framing Measures	Points Earned
Use exterior wall shear technique other than wood sheathing for the whole building	1
Use wood wall sheathing for shear only at corners	0.5
Space joists greater than 16" o.c.	0.5
Space studs greater than 16" o.c	0.5
Design roof pitch/eave width to 24" module	0.5
• Size headers for actual loads • Use ladder blocking or drywall clips • Use 2-stud corners	2 of 3 measures: 0.5

@CET

53

Environmentally Preferable Products

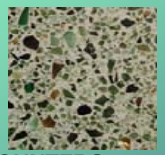
FLOORING

Recycled Content

Meets Emission Specs

Locally Sourced

INSULATION



COUNTERS

PAINTS & ADHESIVES

LUMBER

@CET

54

Construction Waste & Recycling

REDUCE

REUSE

RECYCLE

136 Million Tons of Construction and Demolition Waste is Produced ANNUALY in the U.S.

@CET

55

NAHB Construction Waste Estimate of a Typical 2,000 S.F. Home

Material	Weight (Lb)	(Lb / SF)
Solid Dimensional Wood	1,600	0.8
Engineered Wood	1,400	0.7
Drywall	2,000	1.0
Cardboard	600	0.3
Metal	150	0.08
PVC	150	0.08
Masonry	1,000	0.5
Hazardous Materials	50	0.03
Other	1,050	0.53
	8,000	4.0

@CET

56

Improved Indoor Air Quality

Proper Ventilation & Filtration
- Controls moisture levels
- Provides Oxygen for occupants
- Filters and Exhausts Contaminants

RADON Testing and Mitigation

Indoor Environmental Quality

- Reduce Materials that Off-Gas
  Paints, Caulks, Cabinets, Finishes
- Vent all Carbon Monoxide Producing Appliances
- Reduce Dust and Dirt
- Address Radon Removal

Awareness & Education

- Host several open houses
- Produce article about the home
- Provide Homeowner Education
- Create Homeowner Operations Manual

Green Building Wrap Up:

- Energy efficient building envelope and mechanical systems
- Create healthier indoor air quality
- Designed for greater durability
- Avoids environmentally sensitive sites
- Reduced construction waste
- Improved water conservation
- Environmentally preferable materials

CET

61

Green Building:

Catch the Wave before it becomes a *TSUNAMI*

Peggy MacLeod
Marketing Director, Green Building Services
Center for Ecological Technology

Belchertown MA 3-25-08
Lenox MA 4-23-08

CET

www.cetonline.org

Building Green Benefits

YOU

&

CET

62