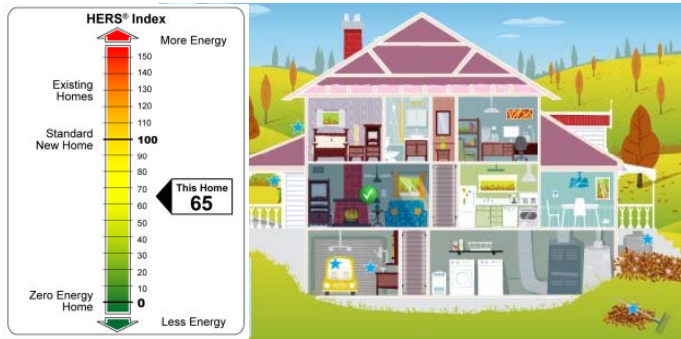


# STRETCH CODE WORKSHOP

A Green Step Ahead: A Workshop for Municipalities Considering Adopting the Stretch Code

Thursday, January 21, 2010



# STRETCH CODE WORKSHOP

The Franklin Regional Council of Governments would like to extend a special “Thank You” to the following individuals and communities:

*Jim Barry, Department of Energy Resources (DOER)*

*Delbert Smith Jr., Consulting Engineering Services (CES), Inc.*

*Sean Jeffords, Beyond Green Construction*

*Doug Snyder, DS Greenbuild*

*Anne Perkins, Rural Development Inc. (RDI)*

*Dan Hellyer, Town of East Longmeadow*

*Town of Lexington*

# STRETCH CODE WORKSHOP

- **Introduction to the Stretch Code, *Jim Barry***
- The HERS Rating System, *Doug Snyder*
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- Closing Remarks, *Jim Barry*



*Helping Massachusetts Municipalities Create A Greener Energy Future*

## Green Communities Program

- DOER Programs & Support for Municipalities
  - Energy Audit Program (EAP)
  - Energy Performance Contracting with ESCo
  - Technical Assistance
  - Energy Information Reporting System (EIS)
  - **Green Communities Grant,  
and Technical Assistance Program**
  - Outreach; Regional Coordinators

## Green Communities Grant Program

- Provides up to \$10M annually in grants and loans to qualifying communities
- Qualification Criteria
  1. Adopt as-of-right siting, in designated locations, for RE/AE generation, or RE/AE R&D, or RE/AE manufacturing
  2. Adopt expedited (12 month) application/permitting process
  3. Establish an energy use baseline inventory with a program to reduce baseline by 20% in 5 years
  4. Purchase only fuel-efficient vehicles
  5. **Require all new residential construction > 3000 ft<sup>2</sup>, and new commercial and industrial real estate construction to minimize life-cycle energy costs.**

**DOER has determined that a municipality can meet this requirement by adopting the BBRs Stretch Code.**

## Stretch Code ...what is it ?

- ICC (International Codes Council) publishes the IECC (International Energy Conservation Code) every 3 years (2006, 2009....).
- Mass BBRS (Board of Building Regulations and Standards) has adopted the IECC 2009 energy code for 2010 ALONG with the optional Stretch code appendix.
- Stretch code uses real-world testing to ensure residential energy savings, and energy modeling to ensure commercial energy savings.

## Stretch Code for New Residential Construction

New low-rise (three stories or less) residential buildings shall require a HERS (Home Energy Rating System) index rating as verified by a RESNET (Residential Energy Services Network) certified HERS rater.

- For units equal to or greater than 3,000 sq ft in conditioned floor space, a HERS rating of 65 or less is required.
- For units less than 3,000 sq ft, a HERS rating of 70 or less is required.
- In addition, all new construction shall demonstrate compliance with the Energy Star Qualified Homes Thermal Bypass Inspection Checklist.

## Why Test Performance?

Prescriptive codes don't guarantee good installation, air and water tightness, or that thermal insulation is effective.

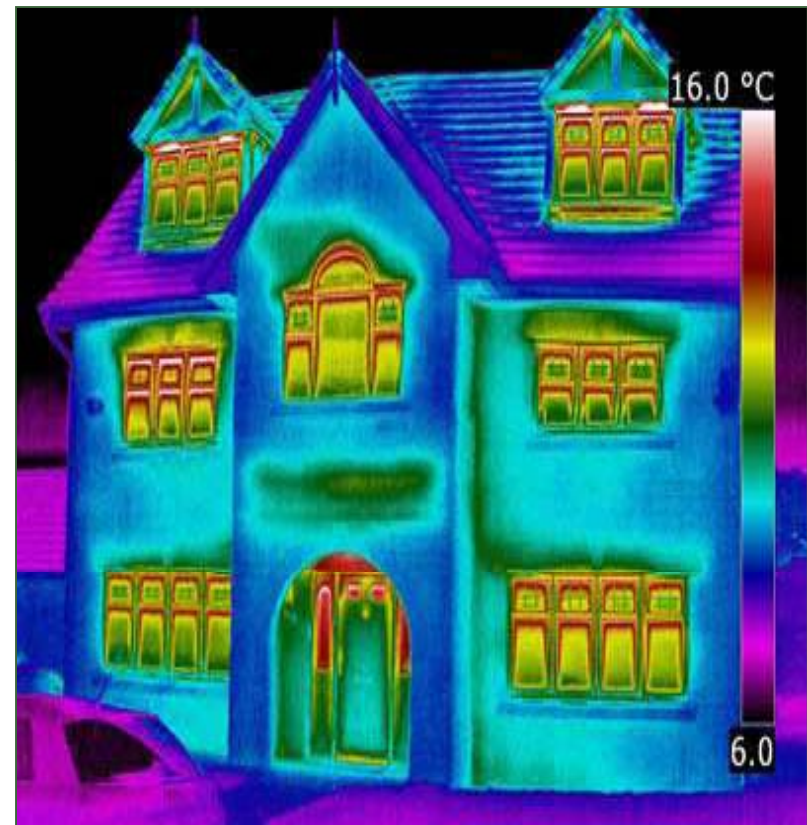
Small air gaps can reduce insulation R-values by 50% or more.



## Why Test Performance?

Design, Installation  
& Equipment all important.

- Blower-door test for air leakage
- Duct test for heating & AC
- Infra-red camera tests thermal barrier install.



## What is a HERS Rating

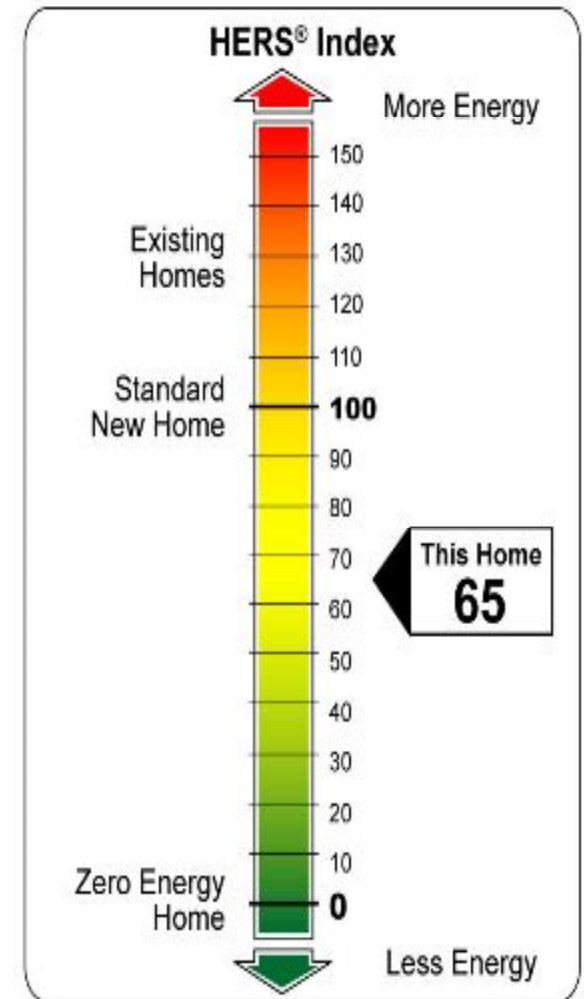
Annualized energy analysis

- Heating, cooling, water heating
- Lighting and appliances
- On site power generation (renewable energy)

Reference Home

- Based on IECC 2006 Code  
(International Energy Conservation Code)  
Defined as 100 Points
- 1 percent change in consumption = 1 point

**HERS 65 means 35% more efficient than reference home**



## **‘Stretch Code’ and ‘Energy Star’**

The Stretch appendix puts the current Energy Star Homes program (at Tier 2 level) into code.

All new residential construction can use the Energy Star homes program to receive:

- Builder incentives/rebates
  - \$1250/home for HERS 65
  - other utility incentives – on appliances, fluorescent lights, etc.
- Builder training and materials
- Subsidized HERS raters



## Incentives, Rebates, Tax Credits

- Stretch code is designed to allow builders to get the maximum benefits of the existing Energy Star Program
- \$1,250 from Energy Star utility sponsors for HERS Rating of HERS 65 or less.
- Additional rebates available for installing high efficiency heating and cooling equipment, appliances and lighting.
- Utility companies partially cover the cost of hiring a HERS rater
- \$2000 federal tax credit for homes built with less than half of the heating and cooling load of a 2004 code home. HERS rater can tell you if your new home qualifies.

## Energy Efficient Mortgages

- Energy Efficient Mortgages make it easier for borrowers to qualify for loans to purchase homes that are already energy efficient or to cover the expenses for making cost-effective energy improvements when purchasing or refinancing older existing homes.
  - Conventional Energy Efficient Mortgages
  - FHA Energy Efficient Mortgages
  - VA Energy Efficient Mortgages

## **Adoption by Towns and Cities**

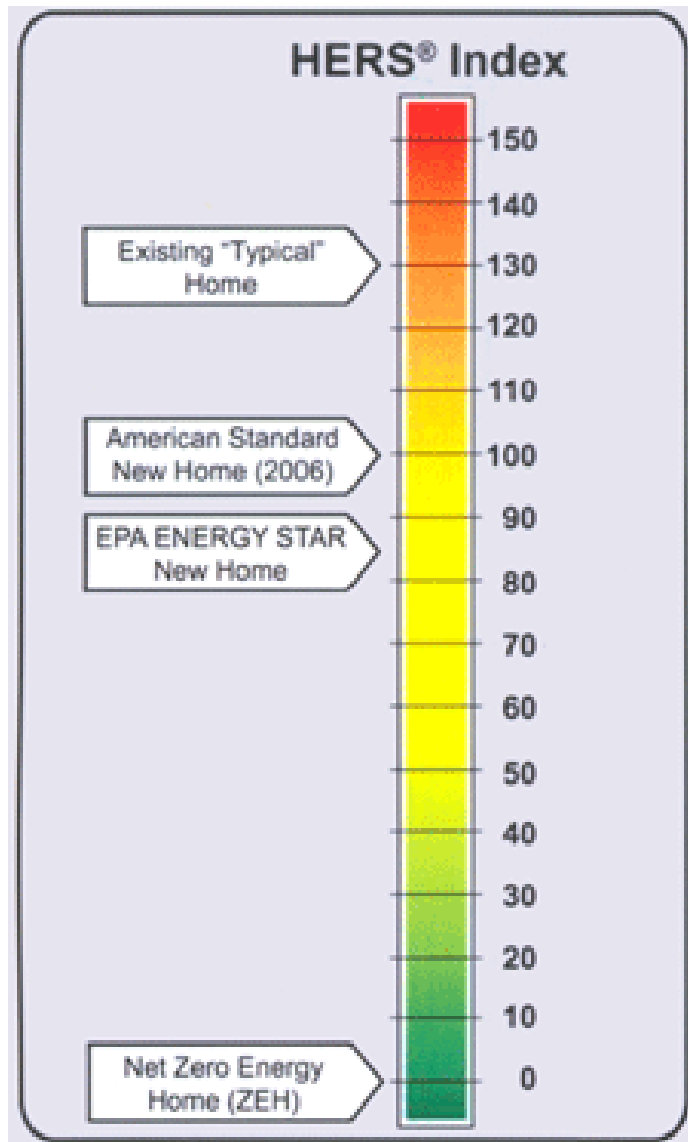
- Adoption Process
  - Building Official Training
  - Municipal Public Hearing
  - Vote of Town Meeting  
or Mayor and City Council
  
- Timing of Adoption
  - Muni vote any time
  - Code change starts on Jan 1 or Jul 1
  - Base & Stretch code both in place  
for the first 6 months (concurrency period)  
Builder can choose EITHER code

## Implementation Timeline Example

- Example of adoption by Town of Canterburg, MA
  - Feb 12, 2010 - Municipal public hearing
  - April 18, 2010 - Vote of City Council or Town Meeting to adopt Stretch CodeCanterburg is eligible to become a Green Community
- Timing of code implementation in Canterburg
  - July 1, 2010 Stretch code implemented alongside base code in Canterburg
  - July→Dec 2010 Building permits can comply with either base code (IECC 2009) or Stretch code until Dec 31, 2010
  - Jan 1, 2011 Stretch code becomes sole energy code in Canterburg – for new building permits

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## Home Energy Rating System HERS

- “Typical” Existing Homes range from 110-150
- “Typical” Newly Constructed Homes 90-110
- Energy Star Homes
  - 85 and lower
- Stretch Code Homes
  - 85 for renovations < 2,000 sf
  - 80 for renovations  $\geq$  2,000 sf
  - 70 for new homes < 3,000 sf
  - 65 for new homes  $\geq$  3,000 sf
- Zero Energy Homes
  - 0 and lower

# History of HERS

- 1995 Founders
  - Natl Assoc. of State Energy Officials
  - National mortgage industry
  - Energy Rated Homes of America
- Purpose
  - Promote the market for home energy ratings and EEMs
- Organization Created
  - RESNET – Residential Energy Services Network

# Recognition

- Mortgage industry
- Financial industry
- Federal Government for verification:
  - Federal tax credit qualification
  - EPA ENERGY STAR labeled homes
  - U.S. Department of Energy Building America program
- Used for minimum code compliance in 16 states

## Who is Involved?

- Rater Providers
- Rater Trainers
- QAD
- Raters
- Testing

## HERS Process – Step 1 Proposed Design Modeling

- Review Building Plans
  - Data collection – insulation, windows, wall to window ratio, HVAC efficiency, building orientation, DHW, air and duct leakage
- Create Model
  - REMRate Software Modeling
  - Standard and Proposed Building
  - US Labs certifies software

## HERS Process – Steps 2 and 3 - Onsite Inspections and Finalize Model

- **First Inspection**
  - Thermal Bypass Checklist
  - Duct tightness test (if applicable)
- **Second Inspection** (often combined with 1st)
  - Insulation
- **Final Inspection**
  - Blower door test
- **Finalize Energy Model**
  - Based on verified performance and equipment
- **Cost**



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# MA Building Code Overview

- New Standard Building Code (in effect January 1, 2010)
  - Residential: IECC 2009
  - Commercial: ASHRAE 90.1 2007
- Stretch Code
  - Residential: ~20% better than New Building Code (IECC 2009)
    - 65 for new homes  $\geq$  3,000 sf
    - 70 for new homes  $<$  3,000 sf
    - 80 for renovations  $\geq$  2,000 sf
    - 85 for renovations  $<$  2,000 sf
  - Commercial: 20% better than ASHRAE 90.1 2007

# Stretch Code Requirements

## RESIDENTIAL: NEW HOMES

### Residential 3 Stories or less

- New homes 3,000 sf or more requires a Home Energy Rating System (HERS) index of 65 or less.
- New homes below 3,000 sf require a HERS index of 70 or less.
- All new residential construction 3 stories or less requires verification of HERS index rating by a Residential Energy Services Network (RESNET) certified HERS rater.
- Must demonstrate compliance with the Energy Star Qualified Homes Thermal Bypass Inspection Checklist (in the handout).



### ENERGY STAR Qualified Homes Thermal Bypass Inspection Checklist

Home Address: _____ City: _____ State: _____		Corrections Needed	Builder Verified	Rater Verified	N/A
1. Overall Air Barrier and Thermal Barrier Alignment	<b>Requirements:</b> Insulation shall be installed in full contact with sealed interior and exterior air barrier except for alternate to interior air barrier under item no. 2 (Walls Adjoining Exterior Walls or Unconditioned Spaces)				
	<b>All Climate Zones:</b>				
	1.1 Overall Alignment Throughout Home	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2 Garage Band Joist Air Barrier (at bays adjoining conditioned space)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.3 Attic Eave Baffles Where Vents/Leakage Exist	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<b>Only at Climate Zones 4 and Higher:</b>				
	1.4 Slab-edge Insulation (A maximum of 25% of the slab edge may be uninsulated in Climate Zones 4 and 5.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<b>Best Practices Encouraged, Not Req'd:</b>				
	1.5 Air Barrier At All Band Joists (Climate Zones 4 and higher)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.6 Minimize Thermal Bridging (e.g., OVE framing, SIPs, ICFs)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Walls Adjoining Exterior Walls or Unconditioned Spaces	<b>Requirements:</b> Fully insulated wall aligned with air barrier at both interior and exterior; <b>OR</b> Alternate for <b>Climate Zones 1 thru 3</b> , sealed exterior air barrier aligned with RESNET Grade 1 insulation fully supported Continuous top and bottom plates or sealed blocking				
	2.1 Wall Behind Shower/Tub	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2 Wall Behind Fireplace	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.3 Insulated Attic Stoops/Walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.4 Attic Knee Walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.5 Skylight Shaft Walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.6 Wall Adjoining Porch Roof	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.7 Staircase Walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.8 Double Walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3. Floors between Conditioned and Exterior Spaces	<b>Requirements:</b> Air barrier is installed at any exposed fibrous insulation edges Insulation is installed to maintain permanent contact with sub-floor above including necessary supports (e.g., staves for blankets, netting for blown-in) Blanket insulation is verified to have no gaps, voids or compression. Blown-in insulation is verified to have proper density with firm packing			
3.1 Insulated Floor Above Garage		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.2 Cantilevered Floor		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Shafts		<b>Requirements:</b> Openings to unconditioned space are fully sealed with solid blocking or flashing and any remaining gaps are sealed with caulk or foam (provide fire-rated collars and caulking where required)			
5. Attic/Ceiling Interface	4.1 Duct Shaft	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.2 Piping Shaft/Penetrations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.3 Flue Shaft	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<b>Requirements:</b> All attic penetrations and dropped ceilings include a full interior air barrier aligned with insulation with any gaps fully sealed with caulk, foam or tape Movable insulation fits snugly in opening and air barrier is fully gasketed				
	5.1 Attic Access Panel (fully gasketed and insulated)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.2 Attic Drop-down Stair (fully gasketed and insulated)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.3 Dropped Ceiling/Soffit (full air barrier aligned with insulation)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5.4 Recessed Lighting Fixtures (ICAT labeled and sealed to drywall)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5.5 Whole-house Fan (insulated cover gasketed to the opening)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6. Common Walls Between Dwelling Units	<b>Requirements:</b> Gap between drywall shaft wall (i.e., common wall) and the structural framing between units is fully sealed at all exterior boundary conditions				
	6.1 Common Wall Between Dwelling Units	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Home Energy Rating Provider: \_\_\_\_\_ Rater Inspection Date: \_\_\_\_\_ Builder Inspection Date: \_\_\_\_\_  
 Home Energy Rater Company Name: \_\_\_\_\_ Builder Company Name: \_\_\_\_\_  
 Home Energy Rater Signature: \_\_\_\_\_ Builder Employee Signature: \_\_\_\_\_

# Stretch Code Requirements

## RESIDENTIAL: ADDITIONS

- Prescriptive option – must conform to the most recent Energy Star for Homes Prescriptive Builders Option Package (BOP, included in the handout) and be in compliance with The Energy Star Qualified Homes Thermal Bypass Inspection Checklist and envelope requirements of IECC 2009.
- Performance option – In lieu of prescriptive option and must meet the requirement for new homes.



### ENERGY STAR Qualified Homes Builder Option Package Notes

2004/2006 IECC Climate Zone <sup>1</sup> – 5

ENERGY STAR Window Zone <sup>2</sup> – Northern

The requirements for the ENERGY STAR Builder Option Package (BOP) are specified in the checklist below. To qualify as ENERGY STAR using this BOP, a home must meet the requirements specified, be verified and field-tested in accordance with the HERS Standards by a RESNET-accredited Provider, and meet all applicable codes.

Home Address:	City:	State:			
Building System	Inspection Guidelines		Rater Verified	Must Correct	NA
Cooling Equipment (Where Provided)	Right-sized <sup>2</sup> ≥ 13 SEER A/C; <u>OR</u>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Right-sized <sup>2</sup> ≥ 14.5 SEER/ 12 EER/ 8.5 HSPF ENERGY STAR qual. HP <sup>3</sup>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heating Equipment	≥ 90 AFUE gas furnace; <u>OR</u>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Right-sized <sup>2</sup> ≥ 14.5 SEER/ 12 EER/ 8.5 HSPF ENERGY STAR qual. HP <sup>3</sup> ; <u>OR</u>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	≥ 85 AFUE boiler; <u>OR</u>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	≥ 85 AFUE oil furnace		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Thermostat <sup>3</sup>	ENERGY STAR qualified thermostat (except in zones with mass radiant heat)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ductwork	Leakage <sup>4</sup> : ≤ 4 CFM to outdoors / 100 sq. ft.; <u>AND</u>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Insulation <sup>5</sup> : ≥ R-6 insulation on ducts in unconditioned spaces		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Envelope	≤ 5 ACH50	Infiltration <sup>6,7</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	≤ Reference UA	UA Alternative Approach <sup>8</sup> ; <u>OR</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	≥ 38 R-Value	Ceiling Insulation <sup>8</sup> ; <u>AND (if applicable)</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	≥ 30 R-Value	Cathedral Ceiling Insulation <sup>8</sup> ; <u>AND (if app.)</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	≥ 19 R-Value	Wood Frame Wall Insulation <sup>8</sup> ; <u>OR (if app.)</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	≥ 13 + 5 R-Value	Wood Frame Wall Insulation and Sheathing <sup>8</sup> ; <u>AND (if app.)</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	≥ 30 R-Value	Floor Over Unconditioned Space Insulation <sup>8</sup> ; <u>AND (if app.)</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	≥ 10 R-Value	Crawspace Wall Insulation Continuous <sup>8</sup> ; <u>OR (if app.)</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	≥ 13 R-Value	Crawspace Wall Insulation Framed <sup>8</sup> ; <u>AND (if app.)</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	≥ 10 R-Value	Basement Wall Insulation Continuous <sup>8</sup> ; <u>OR (if app.)</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	≥ 13 R-Value	Basement Wall Insulation Framed <sup>8</sup> ; <u>AND (if app.)</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	≥ 10 R-Value	Slab Insulation <sup>8</sup> ; <u>AND</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Completed Thermal Bypass Inspection Checklist <sup>9</sup>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Windows <sup>10,11,12</sup>	≤ 0.35 U-Value		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Any SHGC		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water Heater <sup>13,14</sup>	Gas (EF): 40 Gal = 0.61   60 Gal = 0.57   80 Gal = 0.53		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Electric (EF): 40 Gal = 0.93   50 Gal = 0.92   80 Gal = 0.89		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Oil or Gas <sup>15</sup> : Integrated with space heating boiler		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lighting and Appliances <sup>16,17</sup>	Five or more ENERGY STAR qualified appliances, light fixtures, water heaters, ceiling fans equipped with lighting fixtures, and/or ventilation fans		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Revised 03/10/2009

Page 1 of 3

# Stretch Code Requirements

## RESIDENTIAL: ALTERATIONS, RENOVATIONS AND REPAIRS

- Prescriptive option – Alterations, renovations, or repairs that access the building envelope require compliance with the prescriptive option for residential additions. Insulation requirement of R-3.5/inch.
- Performance option – In lieu of prescriptive option and must meet the following HERS indexes:
  - o 80 or less for units equal or greater than 2,000 sf
  - o 85 or less for units less than 2,000 sf
  - o Compliance with the Energy Star Thermal Bypass Checklist

# Residential Compliance Summary

Residential Compliance Paths			
	IECC 2009	Stretch Code New Construction	Stretch Code Renovations and Additions
Prescriptive Path	<p>R Value – No Trade Offs</p> <p>U Factor – No Trade Offs</p> <p>Takes thermal bridging into account (REScheck)</p> <p>Total UA Factor – Trade offs allowed between components (REScheck)</p>	N/A	<p>Energy Star for Homes Prescriptive Builders Option Package</p> <ul style="list-style-type: none"> <li>•Except for heating and cooling equipment and appliances</li> </ul> <p>Energy Star Qualified Homes Thermal Bypass Inspection Checklist</p> <p>Envelope insulation meets or exceeds IECC 2009</p> <ul style="list-style-type: none"> <li>•Renovations - fully fill existing cavities, insulation R=3.5/inch</li> </ul>
Performance Path	<p>Energy usage simulation (REM/Rate) - proposed building's energy usage costs are &lt; "standard reference design" building</p> <p>Uses prescriptive requirements as a starting point and allows tradeoffs except for HVAC</p> <p>Doesn't include lighting</p>	<p>HERS Rating (REM/Rate)</p> <p>≥ 3,000 sf HERS ≤ 65</p> <p>&lt; 3,000 sf HERS ≤ 70</p> <p>Energy Star Qualified Homes Thermal Bypass Inspection Checklist</p>	<p>HERS Rating (REM/Rate)</p> <p>≥ 2,000 sf HERS ≤ 80</p> <p>&lt; 2,000 sf HERS ≤ 85</p> <p>Energy Star Qualified Homes Thermal Bypass Inspection Checklist</p>

# Stretch Code Requirements

## COMMERCIAL OVERVIEW

- Only for New Construction over 5,000 sf  
New Buildings or Building additions
- Performance option for all Buildings  
20% below ASHRAE 90.1-2007
- Prescriptive option for most building types  
5,000 - 100,000 sf
- Exemptions (comply with base code)  
Commercial buildings smaller than 5,000 sf  
Special cases smaller than 40,000 sf (supermarkets,  
laboratories, and warehouses)  
Commercial renovations and existing interior fit-outs  
Historic buildings

# Stretch Code Requirements

COMMERCIAL: ACCORDING TO BUILDING SIZE/TYPE

## BUILDING SIZE

- **Over 100,000 sf** - Only Performance Option
  - Performance Option: Energy model showing 20% below ASHRAE 90.1-2007
- **5,000-100,000 sf** – Performance or Prescriptive Options
  - Performance Option: Energy model showing 20% below ASHRAE 90.1-2007
  - Prescriptive Option: Based on a revised IECC Ch.5 which is based on utility supported 'Core Performance' program. The prescriptive option includes three options: heating and cooling equipment improvements, improved lighting efficiency, or  $\geq 3\%$  of electric needs to come from on-site renewable energy sources.

# Commercial Compliance Summary

Commercial Compliance Paths		
	New Building Code (IECC 2009)	Stretch Code New Construction
Prescriptive Path	Requirements for <ul style="list-style-type: none"> <li>• Envelope insulation values</li> <li>• Fenestration U Values and SHGC</li> <li>• HVAC System Selection</li> <li>• Lighting power density</li> </ul>	Option for buildings 5,000 sf to 100,000 sf Mandatory requirements <ul style="list-style-type: none"> <li>• Envelope</li> <li>• Mechanical systems</li> <li>• Service water heating</li> <li>• Electrical power and lighting</li> </ul> 3 Compliance Paths <ul style="list-style-type: none"> <li>• Higher efficiency HVAC equipment or</li> <li>• Further lighting power density reductions or</li> <li>• On-site renewable energy</li> </ul>
Performance Path	Energy usage simulation - proposed building's energy usage costs are < "standard reference design" building Uses prescriptive requirements as a starting point and allows tradeoffs	Performance 20% better than ASHRAE 90.1-2007 <ul style="list-style-type: none"> <li>• All buildings &gt; 100,000 sf</li> <li>• Option for buildings 5,000 sf to 100,000 sf</li> </ul>

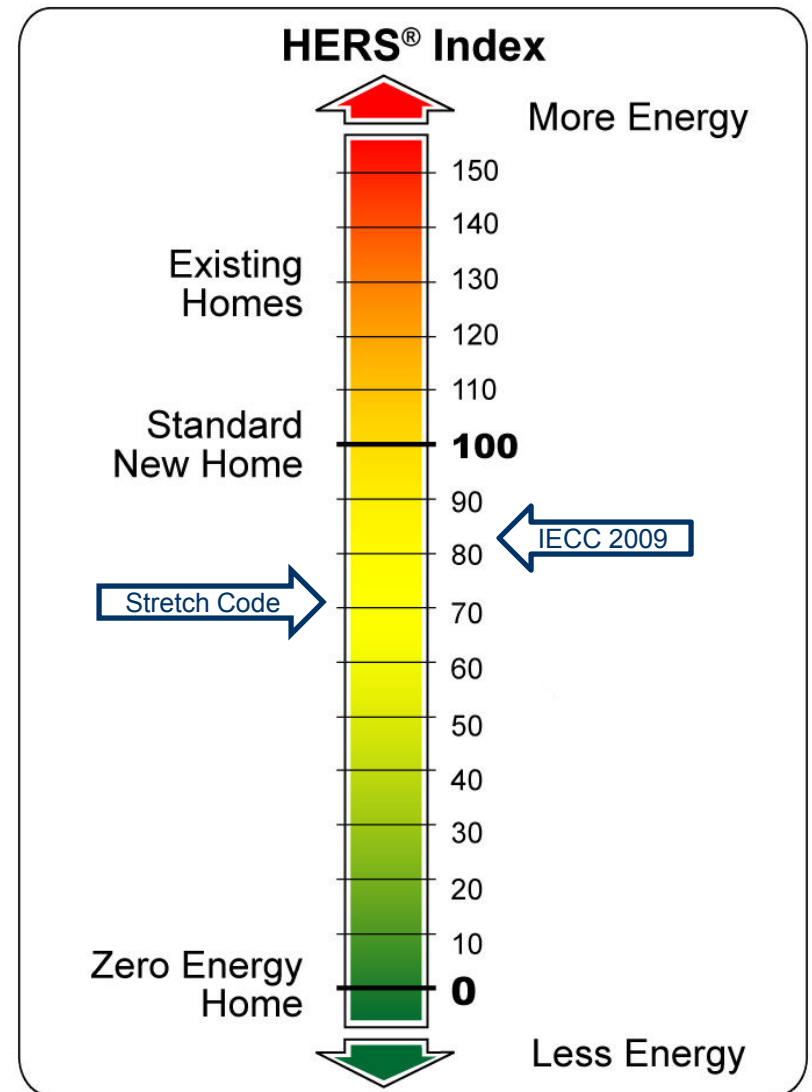
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# **Construction Costs: New Building Code vs. Stretch Code**

# Construction Costs Example: Residential

- New Home – approx. 1500 sf, 2 Stories, Full Basement
  - Home meeting Prescriptive Requirements of the New Building Code Requirements (IECC 2009) earned a HERS rating of 82
    - Improvements Option 1: Add R5 rigid insulation to the exterior of the home, change the basement wall exterior insulation to R15, change the windows U value to 0.30 and put the ductwork under the attic insulation - HERS 70
    - Improvements Option 2: Change to a 92% efficient furnace, 14 SEER condensing unit and an 80% efficient on demand gas fired water heater - HERS 67
  - After improvements: HERS 70 which meets the requirements of the Stretch Code.



# Construction Costs Example: Residential

- Case Study

Study Title	Average Cost Premium %	Average Cost Premium \$/sf	Notes
Energy Star Case Study on Blue Hills, Kansas City, Missouri	1.6%	\$1.60	\$ 2,500 to \$ 5,000 construction cost premium including HERS rating \$ 160,000 total construction cost \$ 500 annual energy savings 1,540 sf homes

# **Energy Savings: New Building Code vs. Stretch Code**

# What is the Energy Saving Target?

- Prescriptive Approach
  - No guarantee of energy savings
- Performance Based Approach
  - Residential HERS rating requirements:
    - 65 for new homes  $\geq$  3,000 sf
    - 70 for new homes  $<$  3,000 sf
    - 80 for renovations  $\geq$  2,000 sf
    - 85 for renovations  $<$  2,000 sf
  - Commercial: 20% improvement over ASHRAE 90.1-2007

# What are Average Annual Energy Costs?

- Performance Based Approach
  - HERS rating of 100 represents a typical new home
  - A HERS rating of 70 (Stretch Code requirement for a new home < 3,000 sf) represents a 30% improvement in energy consumption compared to a typical new home
  - What does a typical new home use for energy annually?

## What are Average Annual Energy Costs?

- U.S. Energy Information Administration
  - 2005 Residential Energy Consumption Survey
    - Average housing unit in New England uses \$0.98/sf
  - Case Study: New Home (1,500 sf)

Cost of Energy Consumption (1,500 sf new home)		
	Annual Energy Cost (\$/sf)	Annual Energy Cost (\$)
New England Average	\$0.98	\$1,470
HERS 70	\$0.67	\$1,005
Total Energy Savings	\$0.31	\$465

# **Summary of Cost Issues: New Building Code vs. Stretch Code**

## Cash-Flow for HERS 60 new home: 2,672 square feet, 3 bedrooms

Note: The HERS Stretch Code requirement is 70 or less for a home of this size (<3,000 sf).  
 (Mortgage Interest Rate = 5%, Loan Term = 30 years)

Description	Annual Costs	Monthly Costs
Total Improvement Costs	\$9,000	
Mortgage Payment Increase	\$580	\$48
Energy Costs before Improvements	\$3,103	\$259
Energy Cost after Improvements	\$1,739	\$145
Energy Cost Savings	\$1,364	\$114
Mortgage Payment Increase	\$580	\$48
Energy Cost Savings	\$1,364	\$114
<b>Total Savings</b>	<b>\$784</b>	<b>\$66</b>

expenses in red, savings in green

Include the cost of a HERS Rater, rebates, incentives and credits

Description	Cost
Total Improvement Costs (from previous example)	+ \$9,000
HERS Rater	+ \$1,500
Energy Star	- \$1,250
Gas Furnace – Utility Company Rebate	- \$1,000
Water Heater – Utility Rebate	- \$300
MA HERS Rater Rebate	- \$750
Federal Tax Rebate for Energy Efficient Appliances	- \$1,500
Total Additional Expenses, Rebates, Incentives and Credits	- \$3,300
Total Improvement Costs (from previous example)	+ \$9,000
Adjustments	- \$3,300
<b>Adjusted Improvement Costs</b>	<b>+ \$5,700</b>

## Cash-Flow for HERS 60 new home: 3,100 square feet

Note: The HERS Stretch Code requirement is 65 or less for a home of this size (≥3,000 sf).  
 (Mortgage Interest Rate = 5%, Loan Term = 30 years)

Description	Annual Costs	Monthly Costs
Total Improvement Costs	\$9,401	
Mortgage Payment Increase	\$606	\$51
Energy Costs before Improvements	\$3,600	\$300
Energy Cost after Improvements	\$2,018	\$168
Energy Costs Savings	\$1,582	\$132
Mortgage Payment Increase	\$606	\$51
Energy Cost Savings	\$1,582	\$132
<b>Total Savings</b>	<b>\$976</b>	<b>\$81</b>

expenses in red, savings in green

## Case Study: Commercial Building

*Mid-sized office building in Warwick, RI which meets the requirements of the Stretch Code for commercial properties (20% better than ASHRAE 90.1 2007)*

Description	Cost
Total Improvement Costs	\$91,000
National Grid Rebates	- \$63,000
Adjusted Improvement Costs	\$28,000
Annual Energy Savings	\$29,000
Adjusted Improvement Costs	\$28,000
Annual Energy Savings	\$29,000
<b>Net Cost of Improvements After 1 Year</b>	<b>\$1,000</b>

expenses in red, savings in green

# STRETCH CODE WORKSHOP

- Introduction to the Stretch Code, *Jim Barry*
- The HERS Rating System, *Doug Snyder*
- Stretch Code Requirements, *Jim Barry*
- Projected Costs, *Del Smith*
- **Case Study, Sean Jeffords**
- Closing Remarks, *Jim Barry*

## East Street Base Case-- Existing HERS Rating 118 1,300 SF

### Building Enclosure:

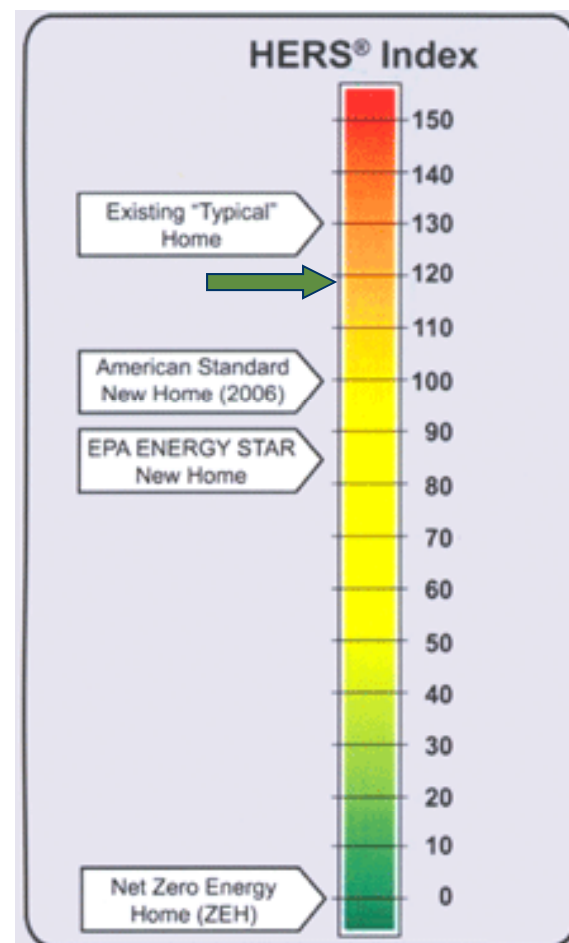
- Basement no insulation, bulkhead weak
- Walls R 6.5, Windows U-Value .46
- Roof R13
- Blower Door: 3970 CMF50

### Electrical System:

Heating 85% efficient, no ventilation

**Appliances:** One Energy Star, 2 not

**Renewables:** None



COLLABORATIVE TEAMWORK

INTEGRATED DESIGN

HIGH PERFORMANCE BUILDINGS



## Plan A: 42 % Reduction from 118 = HERS 68

**Note: A HERS Rating  $\leq 85$  is required to satisfy the Stretch Code for the renovation of a home  $< 2,000$  sf.**

### Building Enclosure:

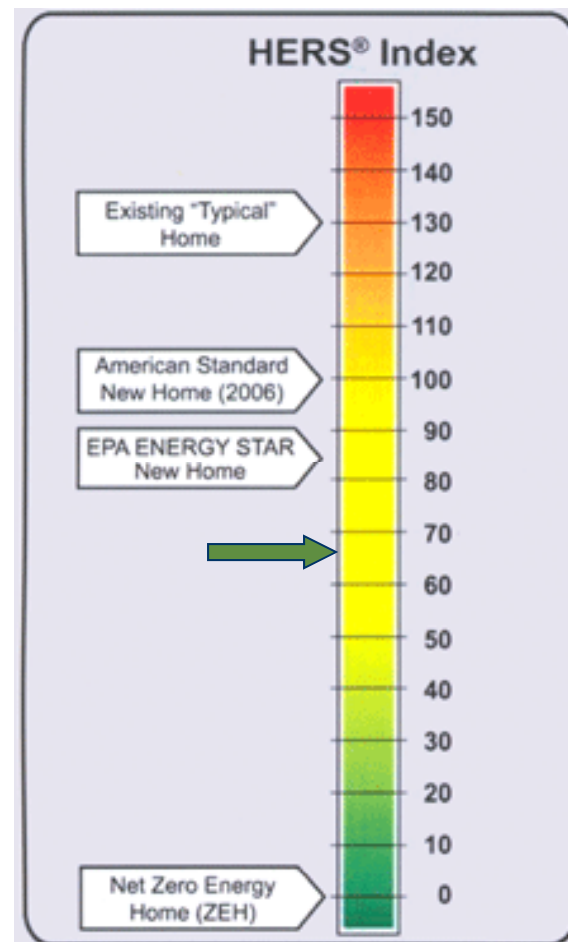
- R-15 foundation walls and rim
- Insulated door for bulkhead
- R16 walls- 4” Dense pack cellulose
- R60 roof- 2” Polyiso, 13” cellulose

### HVAC:

Add ventilation- HRV  
Boiler Draft supply

### Electrical System:

Upgrade light bulbs CFL's

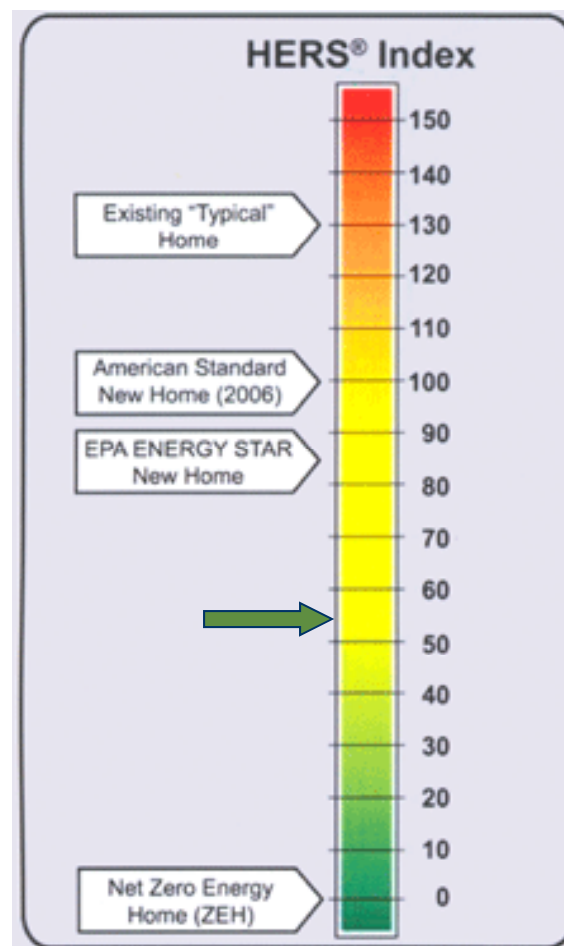


**Plan B is 10% better than Plan A- (42%)**  
**Plan B = 52% reduction = HERS 56**

**Plan B:**

**Building Enclosure:**

- Upgrade Walls from R-16 to R29 with the addition of 2" rigid polyiso foam board
- Wall- Air Barrier Sealing will be taped and sealed with greater detail than plan A
- Drainage Plain and new siding will be installed

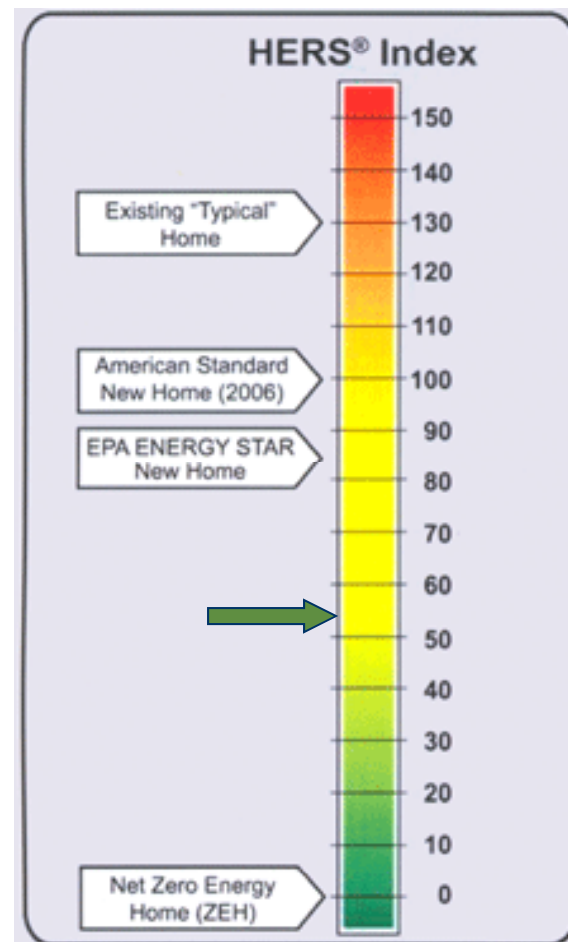




**Plan C is 4% better than Plan B- (52%)**  
**Plan C = 56% reduction = HERS 52**

**Building Enclosure:**

Serious Windows 725 Series installed,  
U-Value 0.19 for N,E,W and 0.24 for  
South. SHGC higher for South



**Plan D is 7% better than Plan C- (56%)**

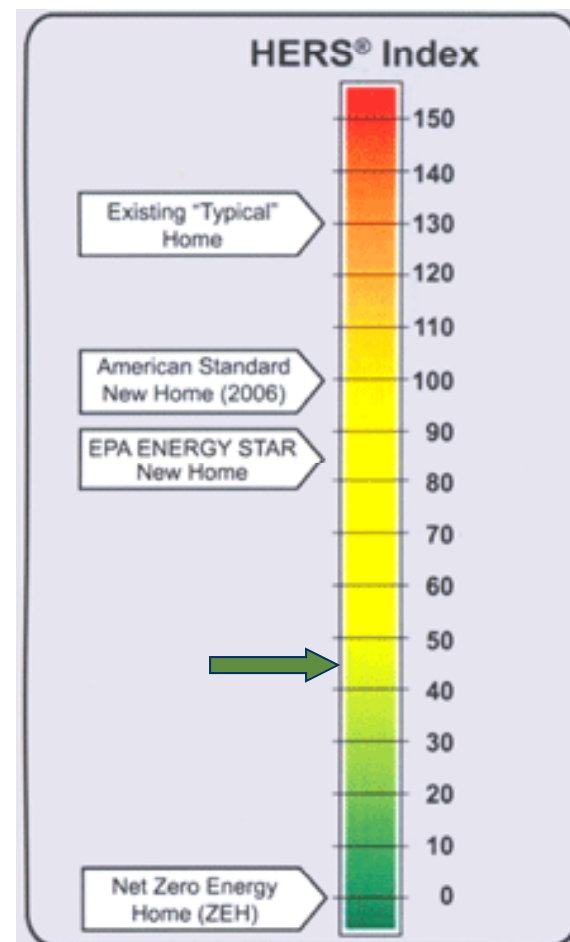
**Plan D = 63% reduction = HERS 44**

**Electrical/Mechanical:**

DHW 0.78 EF, Indirect 52 Gal HW tank,  
Shower head @ 1.6 GPM x 10 min/day  
Saves 29 gal/day or 10,585gal/yr

**Appliances:**

- Dishwasher upgrade: 181 kWh/yr  
EF=1.23 Bosch - Mod: SHE68E05UC
- Fridge: 344 kWh/yr  
Whirlpool Mod:G9RXXFMWS
- Washing Machine: 110 kWh/yr Samsung  
Mod: WF2301H

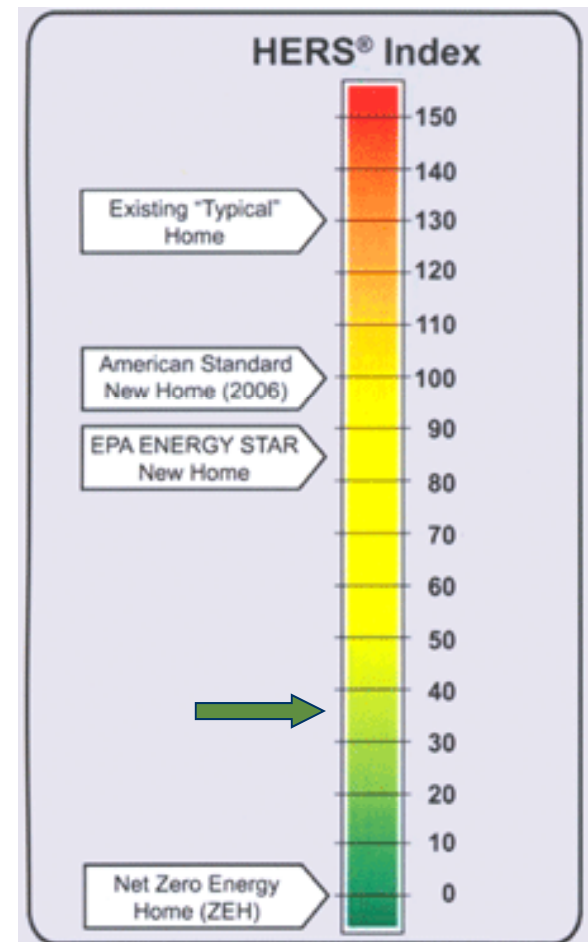


## East Street Design Plan E: 70 % Reduction, HER's 30

Plan E is 7% better than Plan D- (63%)  
Plan E = 63% reduction = HERS 35

### Renewables:

Solar Hot Water -  
Thermomax 30 Evacuated Tube,  
Stiebel Eltron System  
8.6 MMBtu/year



# STRETCH CODE WORKSHOP

## Summary of Benefits

- **Incentives, Rebates and Tax Credits for Energy Efficiency**
- **Town Benefits**
  - Green Communities Funding
    - Funding received from the Green Communities Grant Program can be used to offset the additional costs associated with the Stretch Code
  - Energy savings and reduced energy bills
- **Realtor Benefits**
  - High efficiency homes may sell faster if marketed appropriately
- **Global Benefits**
  - Reduced greenhouse gas and environmental pollution
- **Economy & National Security**
  - Every dollar saved on energy stays in the local economy
  - Creates local jobs
  - Reduced dependence on foreign resources