

Energy Star and Indoor airPLUS: Improve Your Environment, Inside and Out

Mike Duclos
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mike_duclos@ieee.org

Energy Efficiency Associates
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What I've learned lately ...

- Certified HERS Rater w/Mass EnergyStar
- Certified Building Science IR Thermographer
- Certified Passive House Consultant
- There is a lot more to learn ...

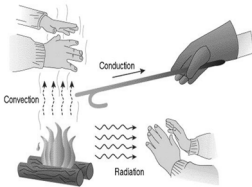
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What I've done lately ...

- Mass. Zero Energy Challenge – 2nd Place
- Zero Net Energy – @ Zero additional cost
- National Grid DER Pilot – In process
- Thousand Homes Challenge – Option B !!!
- Passive House – New design in process
- Passive House Retrofit – Feasibility studies
- Deep Energy Retrofit – Multiple designs
- Home Energy Audits – Adventures in homes

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What is Heat ?



- Transfer of energy from one object to another due to a difference in temperature
- Always from warm to cool

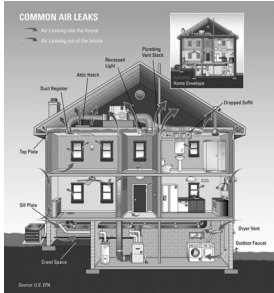
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Heat Flow: Conduction



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Heat Flow: Convection

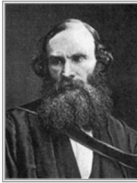


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Heat Flow: Radiation



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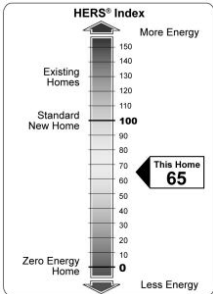


LORD KELVIN

If you cannot measure it, you cannot improve it.

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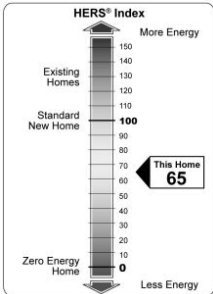
The HERS Index is ...



- 100 = similar energy use as house built to 2004 IECC
- 150 = 50% more energy use (e.g. Existing typical house)
- 85 = 15% less energy use (e.g. EnergyStar I threshold)

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The HERS Index is ...



- One number representing home energy 'goodness'
- A bit of a simplification !
- Sometimes we need simple ...

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The HERS Index is ...



- An 'Asset Rating'
- Uses standardized home operation
- Compares the energy use 'goodness' of buildings, not the occupants

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Who uses HERS ?

- EnergyStar for Homes
- U.S. Energy Efficiency Tax Credit
- Public utilities, government entities
- Energy Efficiency Mortgages
- Massachusetts Zero Energy Challenge
- National Grid DER Pilot program
- Massachusetts Stretch Code
- Massachusetts Adopts IECC 2009

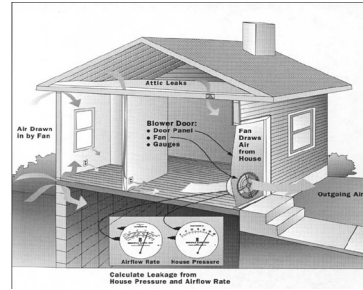
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EnergyStar for Homes

- Prequalify home design with preliminary HERS computer model 'from plans'
- Thermal Bypass Checklist Inspection
- Blower Door, Duct Blaster Measurements
- Final Inspection
- Final "as built, as tested" HERS Index
- Mass. EnergyStar Tier I, II, III levels

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Blower Door Measurement & Diagnostic



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Duct Leakage Measurement & Diagnostic



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Duct Leakage Videos

- Fog Injection into air handler
- Attic Duct leakage visualized

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Thermal Bypass Checklist

ENERGY STAR Qualified Homes Thermal Bypass Inspection Checklist		Pass	Fail
Item	Inspection Guidelines	Pass	Fail
1. Overall Air Barrier and Thermal Barrier Alignment	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)		
1.1 Overall Alignment Throughout Home		<input type="checkbox"/>	<input type="checkbox"/>
1.2 Garage Band Joist Air Barrier (at bays adjoining conditioned space)		<input type="checkbox"/>	<input type="checkbox"/>
1.3 Attic Eave Baffles (where Ventrol leakage exist)		<input type="checkbox"/>	<input type="checkbox"/>
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"/>
1.5 Air Barrier At All Band Joists (Climate Zones 4 and higher)		<input type="checkbox"/>	<input type="checkbox"/>
1.6 Minimize Thermal Bridging (e.g., OVE framing, SIPs, ICFs)		<input type="checkbox"/>	<input type="checkbox"/>

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Thermal Bypass Checklist



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	Requirements: 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)				
All Climate Zones:					
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 Ventrol leakage exist)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Only at Climate Zones 4 and Higher:					
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"/>
Best Practices Encouraged, Not Req'd:					
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"/>

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**If so much money depends on
HERS then ...**

- Correct use must be clearly defined
- Easy to detect errors, fraud
- QA / QC Process needed
- Corrective action will be needed
- System must be 'trusted'
- Abuse, misuse cannot be tolerated


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HERS as A Trusted System

- HERS Software must be Certified
- Certified HERS Raters use software
- Raters work under HERS Providers
- Models constructed to HERS protocol
- Providers perform QA/QC on ratings
- Programs perform QA/QC on ratings

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**Joint Management Council
Mass New Homes with ENERGY STAR Homes
by David Ruggiero**




2009 QA Program Goals

- 100 sets of plans and qualifying REM files
- 25 TBC Inspections
- 75 Final Inspections

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**Joint Management Council
Mass New Homes with ENERGY STAR Homes
by David Ruggiero**




Findings - Plans Analysis

- Individual errors occur
 - Incomplete and illegible plans
 - Bad math
- Average results remain consistently even
 - HERS Index differential of just .29%
 - Only 2 instances of incorrect tier ratings

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**Joint Management Council
Mass New Homes with ENERGY STAR Homes
by David Ruggiero**



Findings - Field Inspections

- ENERGY STAR
- Testing methods
- CFL's
- Ventilation
- Average results remain consistently even
 - HERS Index differential of just .51%
 - Only 3 instances of incorrect tier ratings

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Using HERS

- HERS primary use is in new homes
- HERS also used in renovations to guide design of renovation package

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New Home Design Performance & Cost Optimization



- Tried many variations
- Walls/roof/basement
- Thermal boundaries
- PV & Solar Thermal variations

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Model vs. Bills Disconnect



- Architect designed
- Built in 1978
- Computer model projected 777 gal. fuel oil use per year
- Actual over 1100 gal.
- Why ?



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Deep Energy Retrofit



- Philly style' two family
- National Grid Deep Energy Retrofit pilot HERS 139 -> 23 !
- Thousand Homes Challenge Option B !

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EnergyStar for Homes



- HERS computer modeling for feedback
- Learning to make better buildings
- Measure, inspect, verify 'as built'
- Quality Control & Quality Assurance
- Incentives, financial and technical support
- Market identity and market advantage
- Comfortable, healthy and efficient homes

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Mass. Energy Star Program

- www.energystarhomes.com

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Thank you for your kind attention