Abe Kruger
2013 RESNET Conference
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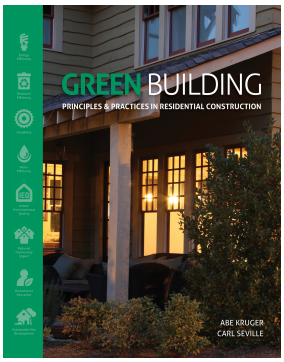
215/385-6891

Agenda

- HERS Industry
- HERS Ratings
- Becoming a HERS Rater
- Business models
- Equipment
- ENERGY STAR
- Other Government Programs
- Green Building Programs
- Rebates and Financial Incentives
- Resources

About Me

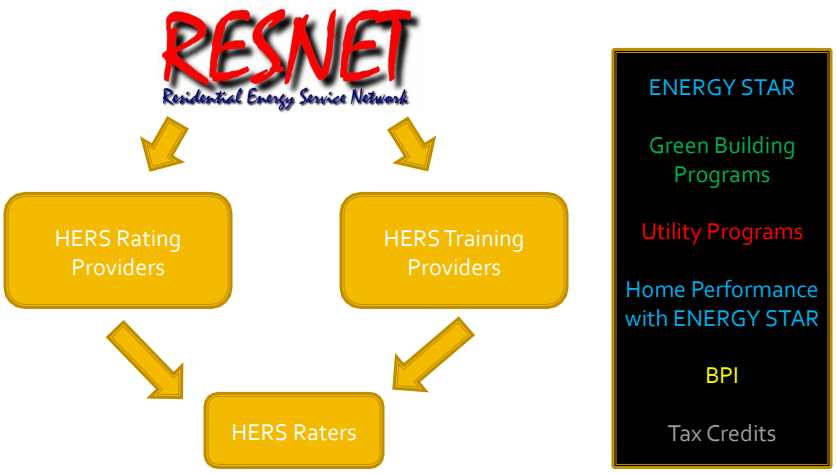
- HERS Rater & Trainer/QAD
- BPI Building Analyst & Proctor
- LEED AP Homes & ND
- LEED Green Rater
- EarthCraft Technical Advisor
- Educator
- Curriculum development
- Member RESNET Technical Committee
- Utility DSM Program Design & Implementation



Introductions

- Audience
  - HERS Raters?
  - Code officials?
  - HVAC contractors?
  - Insulators?
  - Architects?
  - Government employees?
  - Where from?

HERS industry



RESNET

The Residential Energy Services Network's (RESNET®) mission is to ensure the success of the building energy performance certification industry, set the standards of quality, and increase the opportunity for ownership of high performance buildings. RESNET is a membership 501-C-3 non profit organization.

www.resnet.us

RESNET

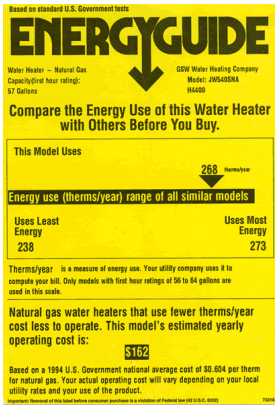
- Board of Directors
- Staff
- Committees
  - Quality Assurance
  - Training and Education
  - Technical
  - Standards
  - COMNET
  - Ethics and Appeals
  - Accreditation

RESNET

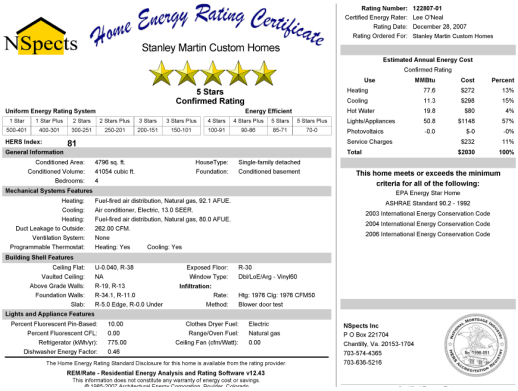
- HERS Standards
- Represent the industry- our lobbyists!
- Annual conference

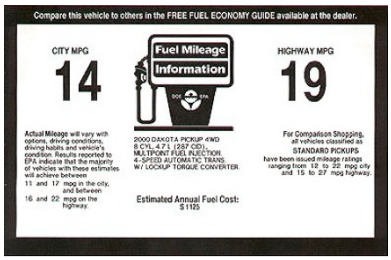
HERS Ratings

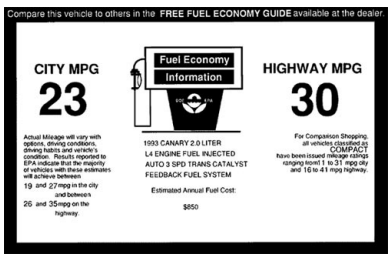
- HERS Ratings consists of
  - Assessment of building components
  - Performance testing
  - Software modeling
  - Reporting



HERS Rating is the Home's Mileage







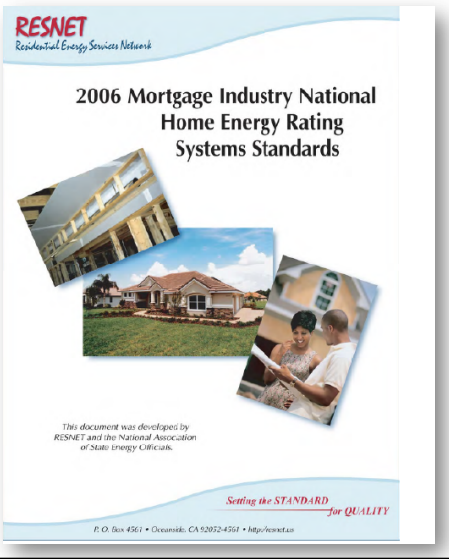
HERS is Recognized by

- Mortgage industry for capitalizing energy efficiency in mortgages
- Financial industry for certification of "white tags"
- Federal government for verification of building energy performance for:
  - Federal tax credit qualification
  - EPA ENERGY STAR labeled homes
  - U.S. Department of Energy Building America program
- Method of minimum code compliance in 16 states

HERS Standards

Rules and Regulations

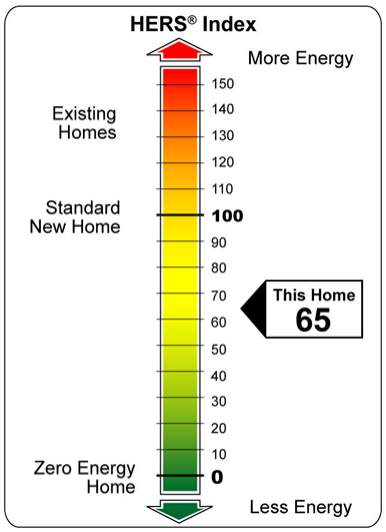
- Raters
- Rating Providers
- Trainers
- Software developers
- RESNET



HERS Ratings

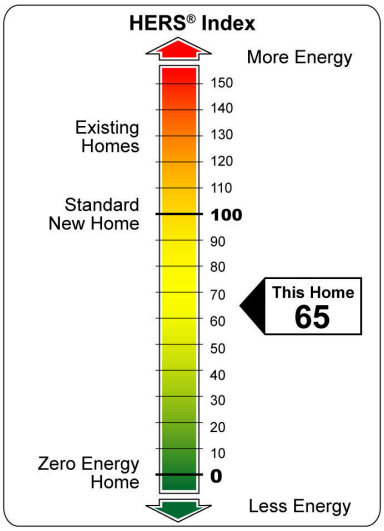
HERS Index of 100 represents the energy use of the "American Standard Building".

HERS Index of 0 (zero) represents a home using no net purchased energy (a Zero Energy Building).



HERS Index

- HERS Index accounts for:
  - Heating
  - Cooling
  - Water Heating
  - Lights
  - Appliances
- Lower is better



Rated vs. Reference Home

Feature	Rated Home	Reference Home
Location	Actual	Actual
Size & Shape	Actual	Actual
Windows	Actual	18% of floor area, evenly distributed
Insulation	Actual	2004 IECC
HVAC	Actual	2004 IECC
Infiltration	Actual	SLA = 0.00048

HERS Training Providers

- Accredited by RESNET
- 70+ Training Providers around the country
- A full list can be found here:

http://www.resnet.us/programs/training/directory.aspx

HERS Training

- Typically a week long course
- Classroom and field
- HERS Software
- RESNET Rater test
  - 2 hours
  - 50 questions
  - ≥ 80% passing score

Training Topics

- Basic principles of building science (i.e., viewing the home as a system)
- The minimum rated features for buildings
- Blower door & duct leakage testing procedures
- Types and efficiencies of windows
- Types and efficiencies of heating, cooling, water heating, and lighting systems
- Types and characteristics of HVAC and domestic hot water
- On-site inspection procedures
- Producing a scaled and dimensioned drawing of a home
- Geometry
- Completing a home energy rating checklist or entering data into a home energy rating software program
- Completing a home energy improvement analysis or entering data into a home energy rating software program that performs improvements analysis
- Basic knowledge of financial incentive programs and energy efficient mortgages
- Communicating the benefits of energy saving measures and practices to the consumer
- Quality assurance

http://www.resnet.us/rater/certified/default.htm

Becoming a Training Provider

- Rating and/or training experience
- RESNET non-refundable $500 application fee
- Annual accreditation fee of $1,750
- Submit all training materials for review
- Must have a HERS Trainer, which requires
  - Pass the RESNET Trainer Test with ≥90% correct
  - Annual CEU's

HERS Rating Providers

- Supplies the Rating software
- Each Rating Provider must employ a certified Quality Assurance Designee (QAD)
- QAD must check a minimum 10% of all building input files
- QAD must verify a minimum of 1% of each certified Rater's homes
- Maintain rater registry, records of CEUs, financial disclosure forms, complaints, etc.
- RESNET ensures Rating Providers compliance

Finding a Rating Provider

- 100+ around the country
- Full list here:

  http://www.resnet.us/programs/providers/directory.aspx

- Tips
  - Find someone reasonably close by
  - Find someone you like working with
  - Ideally the Provider will help you develop your business and supply leads and advice
  - Someone you do not have a conflict of interest

Becoming a Rating Provider

- Be a Rater first
- RESNET non-refundable $500 application fee
- Annual accreditation fee of $1,750
- Must have a QAD, which requires
  - Perform ≥ 25 Ratings
  - Pass the RESNET QAD Test with ≥90% correct
  - Can not check their own ratings

HERS Raters

- HERS Field Analyst
  - Trained and certified to **only** perform inspections
- HERS Rater
  - Performs inspections **and** HERS software models




Becoming a Rater

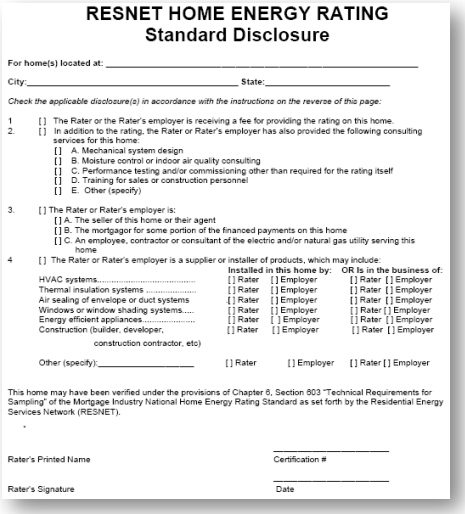
- Complete week-long training
  - Accredited by RESNET
- Pass national online test
- Contract with Rating Provider
- Perform 5 "provisional" ratings under the supervision of QAD/Trainer
- Equipment
- Insurance

Rater Code of Ethics

- Professional Conduct
- Representation of Fees & Services
- Conflicts of Interests

Standard Disclosure

- Complete for every home.
- Given to the Rating client who is responsible to provide a copy to the homeowner/buyer.
- Each form must include, at a minimum, the name of the community or subdivision, city and state where the home is located.



RESNET HOME ENERGY RATING
Standard Disclosure

For home(s) located at: _____

City:_____ State:_____

Check the applicable disclosure(s) in accordance with the instructions on the reverse of this page:

1 [ ] The Rater or the Rater's employer is receiving a fee for providing the rating on this home.
2. [ ] In addition to the rating, the Rater or Rater's employer has also provided the following consulting services for this home:
[ ] A. Mechanical system design
[ ] B. Moisture control or indoor air quality consulting
[ ] C. Performance testing and/or commissioning other than required for the rating itself
[ ] D. Training for sales or construction personnel
[ ] E. Other (specify)

3. [ ] The Rater or Rater's employer is:
[ ] A. The seller of this home or their agent
[ ] B. The mortgagor for some portion of the financed payments on this home
[ ] C. An employee, contractor or consultant of the electric and/or natural gas utility serving this home

4 [ ] The Rater or Rater's employer is a supplier or installer of products, which may include:

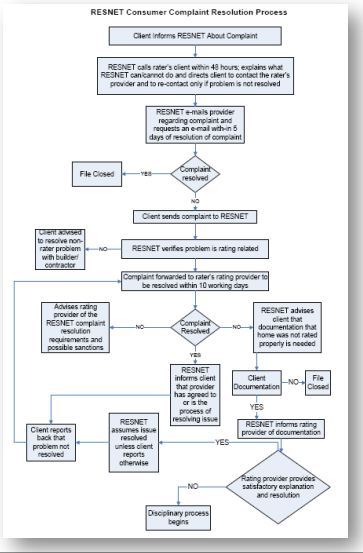
	Installed in this home by:		OR Is in the business of:	
HVAC systems.....	[ ] Rater	[ ] Employer	[ ] Rater	[ ] Employer
Thermal insulation systems	[ ] Rater	[ ] Employer	[ ] Rater	[ ] Employer
Air sealing of envelope or duct systems	[ ] Rater	[ ] Employer	[ ] Rater	[ ] Employer
Windows or window shading systems.....	[ ] Rater	[ ] Employer	[ ] Rater	[ ] Employer
Energy efficient appliances.....	[ ] Rater	[ ] Employer	[ ] Rater	[ ] Employer
Construction (builder, developer, construction contractor, etc)	[ ] Rater	[ ] Employer	[ ] Rater	[ ] Employer
Other (specify):_____	[ ] Rater	[ ] Employer	[ ] Rater	[ ] Employer

This home may have been verified under the provisions of Chapter 6, Section 603 "Technical Requirements for Sampling" of the Mortgage Industry National Home Energy Rating Standard as set forth by the Residential Energy Services Network (RESNET).

Rater's Printed Name _____ Certification # _____

Rater's Signature _____ Date _____

Complaint Resolution Process



Rater's must inform clients of the process.

HERS Raters

- New construction inspections
  - ENERGY STAR
  - Green building programs
  - Energy Efficient Mortgages (EEM)
- Existing homes
  - Energy audits/home performance assessments
  - Utility programs
  - Weatherization
  - Energy Improvement Mortgages (EIM)
  - Home Performance with ENERGY STAR

Green Raters

- RESNET classification of Rater to perform green building inspections.
- Additional two day
- RESNET Green Rater Certificate
- **NOT a USGBC Green Rater!**

BPI Certification

- Building Performance Institute (BPI) founded in 1993 by building tradespersons, project managers and public program professionals.
- Originally focused on certification for weatherization auditors and installation personal.
- Now certification for all residential and multifamily building performance contractors.

www.bpi.org

Rater Business Models

- Performance testing with conventional limited scopes
- Performance testing with broader work scopes and subcontracting
- Integrated whole-house approach with all services offered in-house
- Many offer new and existing home inspections
- 3 case studies

Performance Point

- Based in Charlotte, NC
- Key partnerships with HVAC, waterproofing and spray foam insulation contractors.
- Services
  - Air sealing
  - ENERGY STAR and green building inspections
  - Manual J and D calculations
  - Consulting
  - Existing home inspections and improvements

http://www.theperformancepoint.com/

Environmental Services Group

ESG
ENVIRONMENTAL SOLUTIONS GROUP

- Based in Greensboro, NC
- Services
  - ENERGY STAR and green building certifications
  - Energy audits for homes and businesses
  - IEQ assessments for mold, lead, asbestos, bacteria, moisture and industrial hygiene
  - Environmental health forensics
  - Construction management
  - No improvement/remediation work

www.esgtesting.com

Southern Energy Management

- Based in Raleigh, NC
- Service NC and parts of SC and VA
- ENERGY STAR and green building certification
- Solar PV and hot water for residential, commercial and industrial

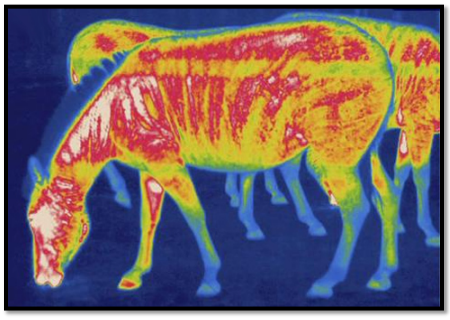
www.southernenergymanagement.com

Building Science Consultant

- How it should work
  - Train builders sales team
  - Train builders and supers
  - Train subcontractors
  - Consult during design phase
  - Review Manual-J load calculation
  - Predrywall inspection
  - Final inspection

Equipment

- At a minimum
  - Blower Door
  - Duct Blaster
  - Computer for HERS software
  - Tape measure
- Additional ~~toys~~ equipment
  - IR Camera
  - Moisture meter
  - Thermometer
  - Air flow meter
  - Digital camera



Zebras at the London Zoo shot with a FLIR camera

Blower Door

The Energy Conservatory

Minneapolis Blower Door

http://www.energyconservatory.com/

Retrotec

Q42 and Q46 Automated Blower Doors

http://www.retrotec.com/

Duct Leakage

Energy Conservatory

Minneapolis Duct Blaster

http://www.energyconservatory.com/

Retrotec

Q32 Duc-Tester

http://www.retrotec.com/

HERS Software

- What you use will be dictated by where you are and what your Rating Provider uses.

ARCHITECTURAL ENERGY CORPORATION
Integrated Engineered Solutions

REM/Rate
www.archenergy.com

EnergyGauge® USA
Energy Software For The New Millennium
Residential Buildings

Energy Gauge
www.energygauge.com

Insurance

- RESNET and the IRS for Tax Credit Verifiers require $500,000 in professional liability insurance.
- RESNET has arranged a package through Lockton Affinity.

Basic premium for individual Raters with at least one year of experience is approximately $1,650* for Professional Liability coverage.

http://www.locktonaffinity.com/resnet/

*These examples represent basic pricing. Premiums can vary depending on the size of the rating enterprise and/or the nature of its operations.

Insurance, cont.

- Green building programs may require something too….

General Liability	**$1,000,000**
Automobile Liability	**$500,000**
Workers Compensation	**As required by law**
Employer's Liability This is typically part of Workers Compensation	**$500,000**
Professional Liability • Covers professionals for negligence and errors and omissions that injure clients. • Professionals are expected to have extensive technical knowledge or training in their particular area of expertise. They are also expected to perform the services for which they were hired, according to the standards of conduct in their profession. If they fail to use the degree of skill expected of them, they can be held responsible in a court of law for any harm they cause to another person or business. • Professionals that operate their own businesses need professional liability insurance in addition to an in-home business or business owner's policy. This protects them against financial losses from lawsuits filed against them by their clients. • When liability is limited to acts of negligence, professional liability insurance may be called "errors and omissions" liability.	**$500,000**

NAHB Requirements for verifiers

Recap

We've covered…

- RESNET
- HERS Ratin
- HERS Traini
- HERS Ratin
- HERS Rater
- Green Rate
- BPI Certification

ENERGY STAR

The national, US government-backed
symbol for
cost-effective
energy efficiency
while assuring same or better performance

ENERGY STAR Background

- **1992** launched
- **50+** products categories
- **1+ Billion** products sold
- **$14 Billion** annual savings
- **25 Million** vehicles equivalent GHG

http://gabrielutasi.com/012007.energy_star.gif

A Growing Brand

- **70%** awareness in 2004
- **4,700+** Active Builder Partners
- **1,400,000+** Labeled Homes

Top ENERGY STAR Markets

Total number of verified homes to date*

- Houston, TX
- Dallas-Fort Worth, TX
- Las Vegas, NV
- Phoenix, AZ
- Greater Los Angeles, CA
- Greater New York, NY
- Tucson, AZ
- San Antonio, TX
- Sacramento, CA
- San Diego, CA
- Columbus, OH
- Des Moines, IA
- Indianapolis, IN
- Austin, TX
- Greater Philadelphia, PA/Wilmington, DE

*Date unknown

ENERGY STAR is…

=

- *Truly Energy Efficient*
- *Credible*
- *Environmental Leadership*

On average 15% more efficient than 2009 IECC code built homes

Energy Efficiency

Green building starts with energy efficiency

- Saving energy prevents pollution
- Saving energy saves water (?!)

Why certify

Which is energy efficient?

EarthCraft House and Energy Star certified
Atlanta, GA 2006

Standard home

Qualifying Homes

- The following homes are eligible to earn the ENERGY STAR:
  - Single-family homes
  - Multi-family buildings three stories or less
  - Multi-family buildings four or five stories and have individual heating, cooling, and hot water systems
  - Multifamily High-rise (6+ stories)

Certification Pathways

Prescriptive Path

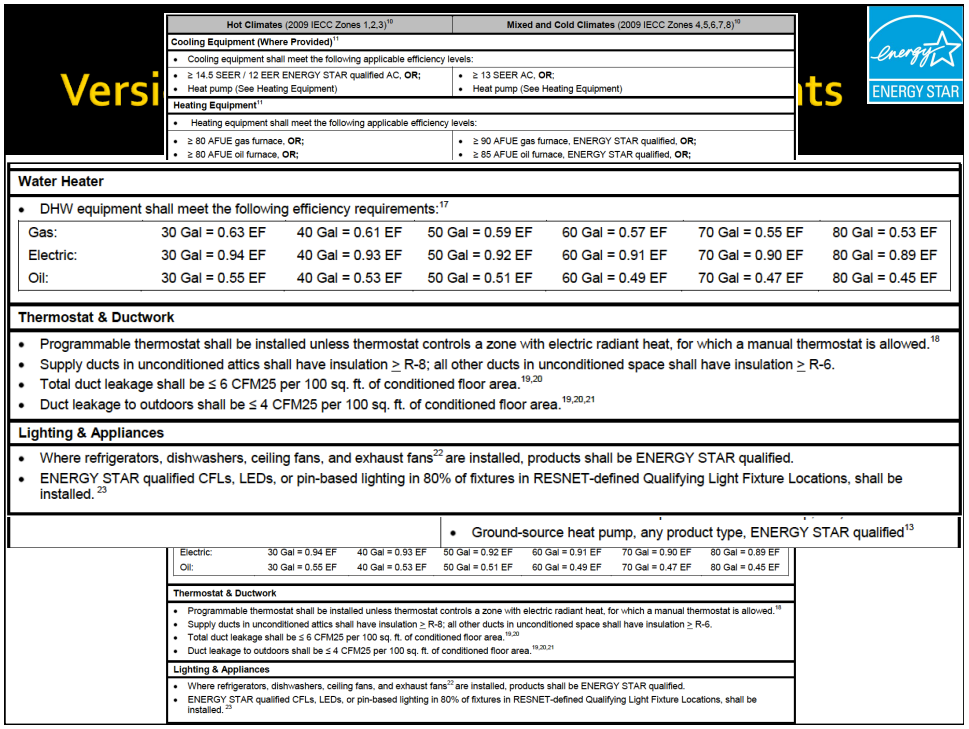
1. Build the home using the ENERGY STAR Reference Design.
2. Complete the inspection checklists.
3. Have Rater Verify Home
4. Place ENERGY STAR certification label on breaker box and provide homeowner with ENERGY STAR certificate.

Performance Path

1. Model the home and find the ENERGY STAR HERS Index Target.
2. Select upgrades that achieve a HERS Index ≤ ENERGY STAR HERS Index Target and meet other program requirements.
3. Complete the inspection checklists.
4. Have Rater Verify Home
5. Place ENERGY STAR certification label on breaker box and provide homeowner with ENERGY STAR certificate.

ENERGY STAR 3.0

- More Stringent Envelope Requirements
- More Stringent Duct Leakage Requirement
- Home Size Adjustment (Performance Path)
- Five New Inspection Checklists
  - Thermal Enclosure System Rater Checklist
  - HVAC System Quality Installation Rater and Contractor Checklists
  - Water Management System Rater and Builder Checklists



Versi ts

Hot Climates (2009 IECC Zones 1,2,3)[10]	Mixed and Cold Climates (2009 IECC Zones 4,5,6,7,8)[10]
Cooling Equipment (Where Provided)[11]	
• Cooling equipment shall meet the following applicable efficiency levels:	
• ≥ 14.5 SEER / 12 EER ENERGY STAR qualified AC, **OR;** • Heat pump (See Heating Equipment)	• ≥ 13 SEER AC, **OR;** • Heat pump (See Heating Equipment)
Heating Equipment[11]	
• Heating equipment shall meet the following applicable efficiency levels:	
• ≥ 80 AFUE gas furnace, **OR;** • ≥ 80 AFUE oil furnace, **OR;**	• ≥ 90 AFUE gas furnace, ENERGY STAR qualified, **OR;** • ≥ 85 AFUE oil furnace, ENERGY STAR qualified, **OR;**

Water Heater

- DHW equipment shall meet the following efficiency requirements:[17]

Gas:	30 Gal = 0.63 EF	40 Gal = 0.61 EF	50 Gal = 0.59 EF	60 Gal = 0.57 EF	70 Gal = 0.55 EF	80 Gal = 0.53 EF
Electric:	30 Gal = 0.94 EF	40 Gal = 0.93 EF	50 Gal = 0.92 EF	60 Gal = 0.91 EF	70 Gal = 0.90 EF	80 Gal = 0.89 EF
Oil:	30 Gal = 0.55 EF	40 Gal = 0.53 EF	50 Gal = 0.51 EF	60 Gal = 0.49 EF	70 Gal = 0.47 EF	80 Gal = 0.45 EF

Thermostat & Ductwork

- Programmable thermostat shall be installed unless thermostat controls a zone with electric radiant heat, for which a manual thermostat is allowed.[18]
- Supply ducts in unconditioned attics shall have insulation ≥ R-8; all other ducts in unconditioned space shall have insulation ≥ R-6.
- Total duct leakage shall be ≤ 6 CFM25 per 100 sq. ft. of conditioned floor area.[19,20]
- Duct leakage to outdoors shall be ≤ 4 CFM25 per 100 sq. ft. of conditioned floor area.[19,20,21]

Lighting & Appliances

- Where refrigerators, dishwashers, ceiling fans, and exhaust fans[22] are installed, products shall be ENERGY STAR qualified.
- ENERGY STAR qualified CFLs, LEDs, or pin-based lighting in 80% of fixtures in RESNET-defined Qualifying Light Fixture Locations, shall be installed.[23]

- Ground-source heat pump, any product type, ENERGY STAR qualified[13]

Benchmark Home Size

- Homes larger must use the Performance Path with Size Adjustment Factor.

Bedrooms	1	2	3	4	5	6	7	8
Conditioned Floor Area	1,000	1,600	2,200	2,800	3,400	4,000	4,600	5,200

Value Through Building Science

If you want your homes to be..

Affordable | Comfortable | Durable

Building science says to have a..

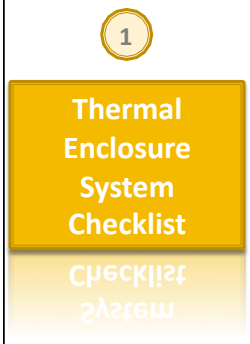
1. Complete Thermal Enclosure System
2. Complete HVAC System
3. Complete Water Management System

Thermal Enclosure System

1. Thermal Enclosure System Checklist

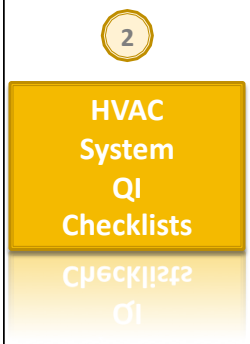
- Features
  - High-quality insulation installation
  - High-performance windows & doors
  - Tightly sealed home
  - Reduced thermal bridging in walls

Thermal Enclosure System



- Why is this important?
  - A well-insulated and air-sealed home, with good windows and doors, reduces the amount of energy needed to keep the home comfortable.

Complete HVAC System



- Features
  - A right-sized and properly installed heating, cooling, and duct system
  - A ventilation system that meets the industry standard
  - Reduced safety and air quality risks from combustion appliances

Complete HVAC System

2

HVAC System QI Checklists

- Why is this important?
  - Improved airflow & efficiency maintain comfort with less energy
  - Proper sizing costs less and better manages humidity levels
  - Ventilation systems remove indoor air pollutants, provide outdoor air, and filter dust and particles

Water Management System

3

Water Management System Checklist

- Features
  - Water-managed roof, walls, foundation, site, and building materials

Water Management System

- Why is this important?
  - Prolonged moisture in walls, floors, and ceilings can cause rot and mold, hurting durability.
  - Wet walls, floors, and ceilings in air-sealed homes don't dry as quickly; therefore, it's more important to not let them get wet.

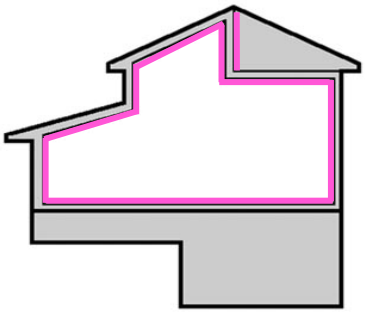
New Training Requirements

- Raters must complete Version 3 training provided by RESNET accredited training providers
- Builders must complete training provided by EPA and HVAC contractors will be required to complete training provided through industry associations
- Training not required, though encouraged, for Version 2.5.

Added Costs of 2011 Specs

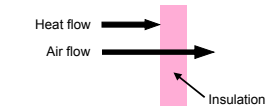
- EPA cost analysis suggest an approximate incremental cost range from $4,000 to $5,000.
- For an average weighted incremental cost of about $4,300, the incremental monthly mortgage is approximately $23/month at currently published interest rates.
- This incremental monthly mortgage is lower than the expected monthly energy savings of approximately $37/month, and thus meets EPA cost-effectiveness criteria.

The Building Envelope

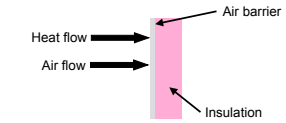


The Building Envelope consists of a thermal barrier and air barrier. They must be contiguous and continuous over the entire building envelope. The two must be perfectly aligned with the air barrier.

Building Science Basics



Most insulation does not stop the flow of air.



Air barrier prevents the flow of air through insulation.

Insulation settling away from sub-floor

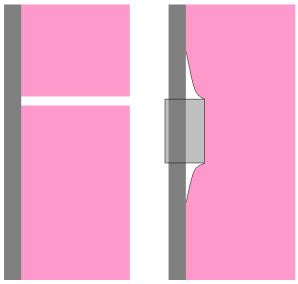
Vertical Insulation

- All wall insulation must be enclosed on all 6 sides to allow proper performance.
- Problem areas: fireplace chases on exterior walls, tubs/showers on exterior walls, attic kneewalls and staircases on exterior walls.

Two installations of air barriers at tubs adjoining exterior walls

Insulation Grading

- ENERGY STAR requires the insulation installation is graded.
- Goal: no gaps, voids or compression.



Gaps (left) and voids (right) allow air to flow through insulation.

Air Sealing Measures

BAD

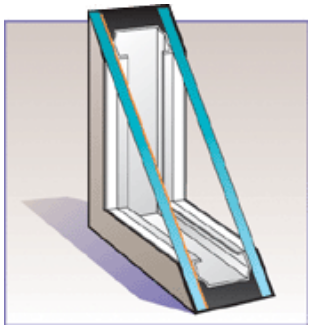
GOOD

Duct Sealing

Recommended: Seal all duct connections with mastic

Seal the boot to subfloor/drywall connection with caulk or mastic

Energy Efficient Windows



Double pane low-e windows

Right-Sized HVAC

- Residential heating and cooling equipment is typically oversized
  - 143% - 322% for cooling
  - 106% - 234% for heating
- Most code officials don't check for Manual J and do not have proper training to

http://www.builtgreen.org/articles/0308_HVAC_sizing.htm

Bigger is not always better

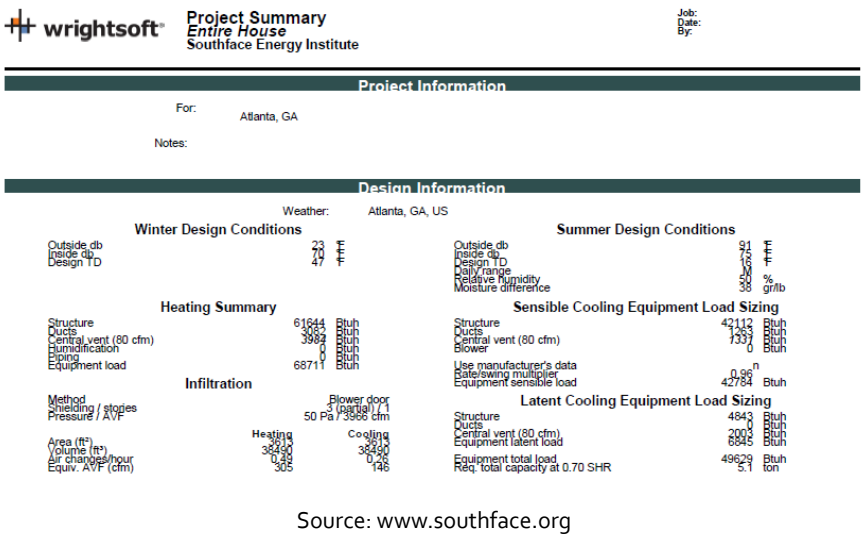
- Higher equipment costs
- Poor dehumidification
- Short cycle
- Large temperature swings
- Lower efficiency and higher operating costs
- Shorter equipment life
- Comfort problems

Checking Load Calcs

ENERGY STAR Requires

- Must be sized according to the latest editions of ACCA Manuals J and S or ASHRAE 2001 Handbook of Fundamentals.
- Maximum over sizing of 15% .
- Outdoor temperatures shall be the 99.0% design temperatures as published in the ASHRAE Handbook of Fundamentals
- Indoor temperatures shall be 75°F for cooling;
- Infiltration rate shall be selected as "tight", or the equivalent term.

Sample Load Calc



wrightsoft

Project Summary
Entire House
Southface Energy Institute

Job:
Date:
By:

Project Information

For: Atlanta, GA

Notes:

Design Information

Weather: Atlanta, GA, US

Winter Design Conditions

Outside db	23	°F
Inside db	70	°F
Design TD	47	°F

Summer Design Conditions

Outside db	91	°F
Inside db	75	°F
Design TD	16	°F
Daily range	M	
Relative humidity	50	%
Moisture difference	38	gr/lb

Heating Summary

Structure	61644	Btuh
Ducts	3083	Btuh
Central vent (80 cfm)	3984	Btuh
Humidification	0	Btuh
Piping	0	Btuh
Equipment load	68711	Btuh

Sensible Cooling Equipment Load Sizing

Structure	42112	Btuh
Ducts	1263	Btuh
Central vent (80 cfm)	1397	Btuh
Blower	0	Btuh
Use manufacturer's data	n	
Rate/sizing multiplier	0.96	
Equipment sensible load	42784	Btuh

Infiltration

Method		Blower door
Shielding / stories		5 (partial) / 1
Pressure / AVF		50 Pa / 3966 cfm
	Heating	Cooling
Area (ft²)	3813	3813
Volume (ft³)	36490	36490
Air changes/hour	0.49	0.26
Equiv. AVF (cfm)	305	146

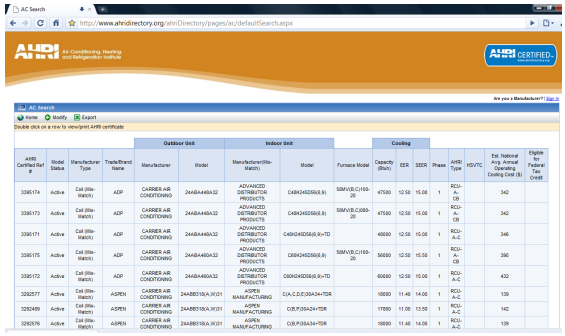
Latent Cooling Equipment Load Sizing

Structure	4843	Btuh
Ducts	0	Btuh
Central vent (80 cfm)	2003	Btuh
Equipment latent load	6845	Btuh
Equipment total load	49629	Btuh
Req. total capacity at 0.70 SHR	5.1	ton

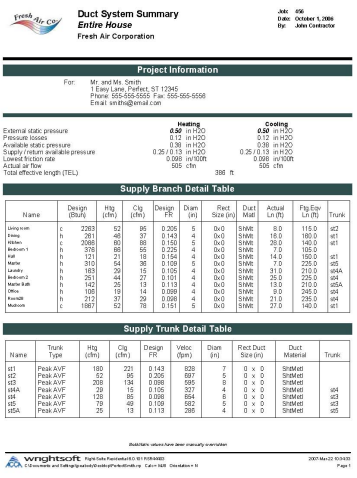
Source: www.southface.org

AHRI Matching

- Indoor & Outdoor A/C or heat pump coils must be properly matched to achieve desired performance.
- ENERGY STAR requirement
- www.ahridirectory.org



Manual D – Duct Design



Duct System Summary
Entire House
Fresh Air Corporation

Project Information

For: Mr. and Ms. Smith
1 Easy Lane, Perfect, ST 12345
Phone: 555-555-5555 Fax: 555-555-5556
Email: smiths@email.com

	Heating	Cooling
External static pressure	0.50 in H2O	0.50 in H2O
Pressure losses	0.12 in H2O	0.12 in H2O
Available static pressure	0.38 in H2O	0.38 in H2O
Supply / return available pressure	0.25 / 0.13 in H2O	0.25 / 0.13 in H2O
Lowest friction rate	0.098 in/100ft	0.098 in/100ft
Actual air flow	505 cfm	505 cfm
Total effective length (TEL)	386 ft	

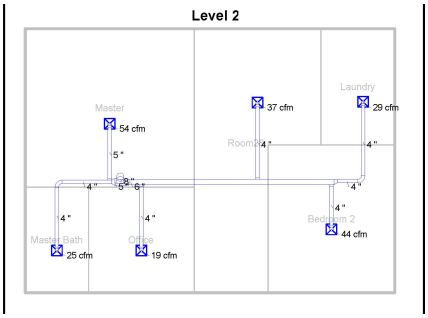
Supply Branch Detail Table

Name		Design (Btu/h)	Htg (cfm)	Clg (cfm)	Design FR	Diam (in)	Rect Size (in)	Duct Matl	Actual Ln (ft)	Fitg Equ Ln (ft)	Trunk
Living room	c	2283	52	86	0.205	5	0x0	SMet	8.0	115.0	st2
Dining	h	261	48	37	0.143	4	0x0	SMet	18.0	180.0	st1
Kitchen	c	2086	80	88	0.150	5	0x0	SMet	28.0	140.0	st1
Bedroom 1	h	316	88	55	0.225	4	0x0	SMet	7.0	105.0	
Hall	h	121	21	18	0.154	4	0x0	SMet	14.0	150.0	st1
Master	h	310	54	36	0.109	5	0x0	SMet	7.0	235.0	st5
Laundry	h	183	29	15	0.105	4	0x0	SMet	31.0	210.0	st4A
Bedroom 2	h	261	44	27	0.101	4	0x0	SMet	25.0	235.0	st4
Master Bath	h	142	25	13	0.113	4	0x0	SMet	13.0	210.0	st5A
Office	h	108	19	14	0.089	4	0x0	SMet	8.0	245.0	st4
Room3B	h	212	37	29	0.098	4	0x0	SMet	21.0	235.0	st4
Mudroom	c	1887	52	78	0.151	5	0x0	SMet	27.0	140.0	st1

Supply Trunk Detail Table

Name	Trunk Type	Htg (cfm)	Clg (cfm)	Design FR	Vdcc (fpm)	Diam (in)	Rect Duct Size (in)	Duct Material	Trunk
st1	Peak AVF	180	221	0.143	828	7	0 x 0	SMet	
st2	Peak AVF	52	86	0.205	697	5	0 x 0	SMet	
st3	Peak AVF	208	134	0.098	595	8	0 x 0	SMet	
st4A	Peak AVF	29	15	0.105	327	4	0 x 0	SMet	st4
st4	Peak AVF	128	85	0.098	664	6	0 x 0	SMet	st3
st5	Peak AVF	79	49	0.109	582	5	0 x 0	SMet	st3
st5A	Peak AVF	25	13	0.113	286	4	0 x 0	SMet	st5

wrightsoft



ENERGY STAR Process

The ENERGY STAR Process

- Plan Review
- Right sized HVAC with Load Calculation
- Duct Design
- Air Sealing Performed
- Pre-drywall Inspection
- Final Inspection with Performance Testing
- Certification

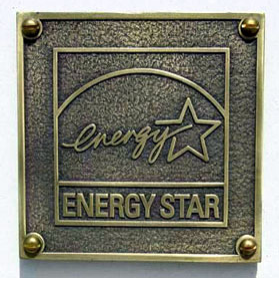
Certification Process

- Option #1: Individually verified
  - Every home receives TBC and final inspection with Blower Door and duct leakage test
- Option #2: Sampling
  - "Batch" a group of homes and test only a portion.
  - Only advised for large production builders who have proven quality control measures.

http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_sampling

Certification Includes

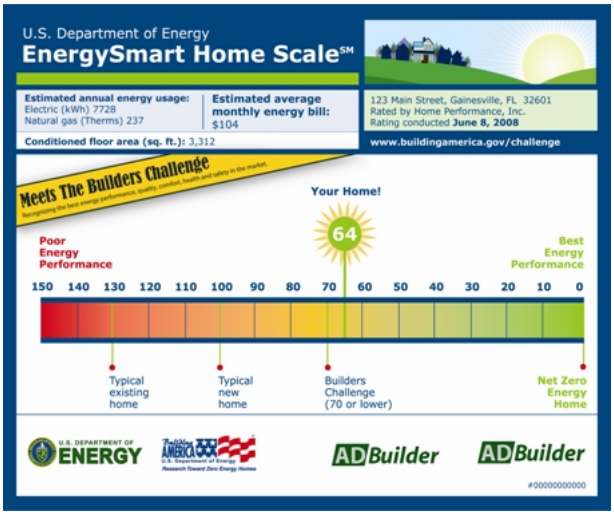
- Paper Certificate
- Sticker on the electrical box
- Optional Bronze Plaque



Other Programs

- DOE's Builders Challenge
- EPA's Indoor airPLUS
- EPA's Water Sense
- ENERGY STAR Advanced Lighting Package

DOE Builders Challenge



http://www1.eere.energy.gov/buildings/challenge/index.html

DOE Builders Challenge

- Performance Path
  - HERS Index of ≤ 70
  - HERS Rater verified
  - Builders Challenge Quality Criteria (BCQC)
- Prescriptive Path

EPA's Indoor airPLUS

Sections

1. Moisture Control
2. Radon Control
3. Pest Barriers
4. HVAC Systems
5. Combustion Systems & Garage Isolation
6. Building Materials
7. Home Commissioning

www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_iap

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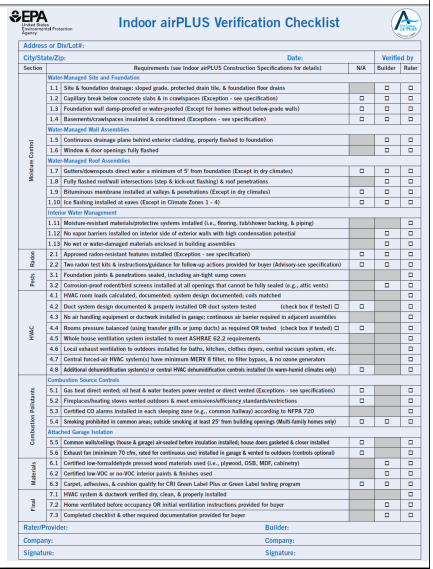
www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_iap

Indoor airPLUS

- Inspection by HERS Rater
- Home must be ENERGY STAR certified
- Rater gives a copy of checklist to their Provider
- Builder gives a copy to home buyer



EPA — Indoor airPLUS Verification Checklist

Address or Div/Lot#:

City/State/Zip: Date:

Section		Requirements (see Indoor airPLUS Construction Specifications for details)	N/A	Verified by: Builder	Verified by: Rater
Moisture Control		**Water-Managed Site and Foundation**			
	1.1	Site & foundation drainage: sloped grade, protected drain tile, & foundation floor drains		☐	☐
	1.2	Capillary break below concrete slabs & in crawlspaces (Exception - see specification)	☐	☐	☐
	1.3	Foundation wall damp-proofed or water-proofed (Except for homes without below-grade walls)	☐	☐	☐
	1.4	Basements/crawlspaces insulated & conditioned (Exceptions - see specification)	☐	☐	☐
		Water-Managed Wall Assemblies			
	1.5	Continuous drainage plane behind exterior cladding, properly flashed to foundation		☐	☐
	1.6	Window & door openings fully flashed		☐	☐
		Water-Managed Roof Assemblies			
	1.7	Gutters/downspouts direct water a minimum of 5' from foundation (Except in dry climates)	☐	☐	☐
	1.8	Fully flashed roof/wall intersections (step & kick-out flashing) & roof penetrations		☐	☐
	1.9	Bituminous membrane installed at valleys & penetrations (Except in dry climates)	☐	☐	☐
	1.10	Ice flashing installed at eaves (Except in Climate Zones 1 - 4)	☐	☐	☐
		Interior Water Management			
	1.11	Moisture-resistant materials/protective systems installed (i.e., flooring, tub/shower backing, & piping)			☐
	1.12	No vapor barriers installed on interior side of exterior walls with high condensation potential		☐	☐
	1.13	No wet or water-damaged materials enclosed in building assemblies		☐	☐
Radon	2.1	Approved radon-resistant features installed (Exception - see specification)	☐	☐	☐
	2.2	Two radon test kits & instructions/guidance for follow-up actions provided for buyer (Advisory-see specification)	☐	☐	☐
Pests	3.1	Foundation joints & penetrations sealed, including air-tight sump covers			☐
	3.2	Corrosion-proof rodent/bird screens installed at all openings that cannot be fully sealed (e.g., attic vents)		☐	☐
HVAC	4.1	HVAC room loads calculated, documented; system design documented; coils matched			☐
	4.2	Duct system design documented & properly installed OR duct system tested (check box if tested) ☐	☐		☐
	4.3	No air handling equipment or ductwork installed in garage; continuous air barrier required in adjacent assemblies			☐
	4.4	Rooms pressure balanced (using transfer grills or jump ducts) as required OR tested (check box if tested) ☐	☐		☐
	4.5	Whole house ventilation system installed to meet ASHRAE 62.2 requirements			☐
	4.6	Local exhaust ventilation to outdoors installed for baths, kitchen, clothes dryers, central vacuum system, etc.			☐
	4.7	Central forced-air HVAC system(s) have minimum MERV 8 filter, no filter bypass, & no ozone generators			☐
	4.8	Additional dehumidification system(s) or central HVAC dehumidification controls installed (in warm-humid climates only)	☐		☐
Combustion Pollutants		**Combustion Source Controls**			
	5.1	Gas heat direct vented; oil heat & water heaters power vented or direct vented (Exceptions - see specifications)	☐		☐
	5.2	Fireplaces/heating stoves vented outdoors & meet emissions/efficiency standards/restrictions	☐		☐
	5.3	Certified CO alarms installed in each sleeping zone (e.g., common hallway) according to NFPA 720			☐
	5.4	Smoking prohibited in common areas; outside smoking at least 25' from building openings (Multi-family homes only)	☐	☐	☐
		Attached Garage Isolation			
	5.5	Common walls/ceilings (house & garage) air-sealed before insulation installed; house doors gasketed & closer installed	☐		☐
	5.6	Exhaust fan (minimum 70 cfm, rated for continuous use) installed in garage & vented to outdoors (controls optional)	☐		☐
Materials	6.1	Certified low-formaldehyde pressed wood materials used (i.e., plywood, OSB, MDF, cabinetry)		☐	☐
	6.2	Certified low-VOC or no-VOC interior paints & finishes used		☐	☐
	6.3	Carpet, adhesives, & cushion qualify for CRI Green Label Plus or Green Label testing program	☐	☐	☐
Final	7.1	HVAC system & ductwork verified dry, clean, & properly installed			☐
	7.2	Home ventilated before occupancy OR initial ventilation instructions provided for buyer		☐	☐
	7.3	Completed checklist & other required documentation provided for buyer		☐	☐

Rater/Provider: Builder:

Company: Company:

Signature: Signature:

EPA's Water Sense

EPA WaterSense℠

ENERGY STAR certification for water fixtures and piloting new homes program.

www.epa.gov/watersense/

Advanced Lighting Package

- The ENERGY STAR ALP designation only applies to new home construction.
- Must install a minimum of 60% ENERGY STAR qualified hard-wired fixtures and 100% ENERGY STAR qualified ceiling fans.

http://www.energystar.gov/index.cfm?c=fixtures.alp_consumers

Recap

We've covered…

- ENERGY STAR
- DOE's Build
- EPA's Indoo
- EPA's Wate
- ENERGY ST ng Package

Green Building Programs

- Approximately 50 different programs around the country.
- Two most popular national programs
  - NAHB Green Building Program
  - USGBC's LEED for Homes

NAHB NATIONAL GREEN BUILDING PROGRAM™

SENSIBLY BUILT FOR THE ENVIRONMENT
EARTH CRAFT HOUSE
SENSIBLY BUILT FOR THE ENVIRONMENT™

U.S. GREEN BUILDING COUNCIL

LEED FOR HOMES

Green Building is…

- Energy Efficient
- Resource Efficient
- Environmentally friendly
- Healthy
- Long lasting
- Quality
- Better
- A home painted green?

It doesn't have to be…

Can be New or Existing Homes

Seville Consulting's
2006 NAHB Green Remodeling Project of the Year

LivingHomes' LEED Platinum Certified

Guiding Principles of Green Building

- Energy Efficiency
- Lot Design, Preparation and Development
- Resource Efficiency
- Water Efficiency
- Indoor Environmental Quality
- Operation, Maintenance and Homeowner Education
- Global Impact

Lot Preparation and Design

When Designing and siting the home

- Preserve trees
- Brown field vs. green field
- Orientate home north-south
- Native, drought tolerant species
- Proximity to Transit and amenities
- Appropriate home size

Tree Protection

Resource Efficiency

Material Selection
- Engineered wood products such as trusses and LVLs
- Rapidly renewable products such as bamboo
- Sustainably harvested and certified wood products

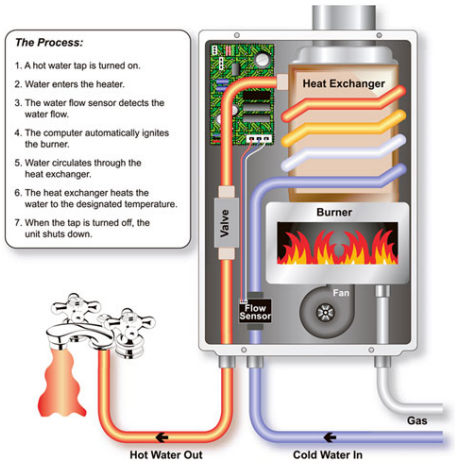
Efficient Lighting

Most efficient light is the sun!

LED Lights

Pin-based CFL

Water Heating



Tankless water heater*

Solar Hot Water

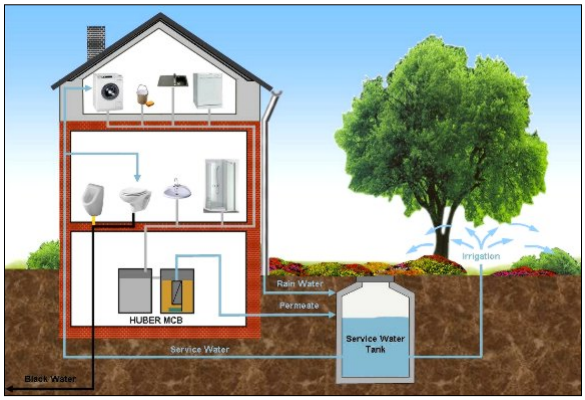
*http://www.hotwaterguys.com/images/tankless_heater_final.jpg

Water Efficiency

Dual-flush toilets

Low-flow shower heads

Water Efficiency



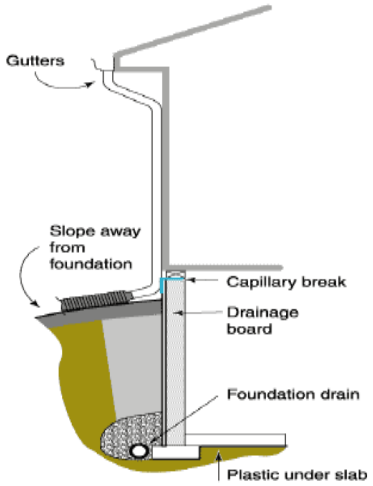
Greywater Collection

Rainwater Collection

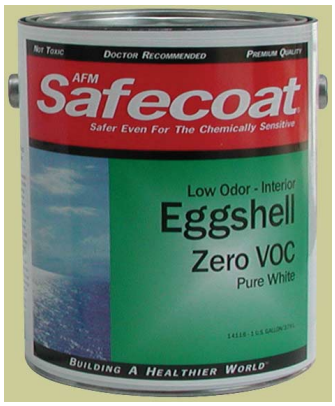
Durability

Keep moisture and bulk water out!

- Proper site drainage
- Foundation drainage board
- Foundation drain
- SealedCrawls
- Exhaust fans
- Proper flashing details



Indoor Environmental Quality

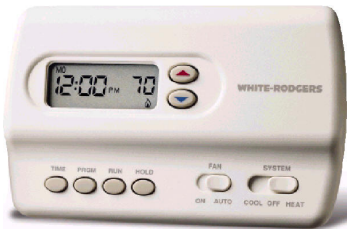


Use low or no VOC paints and finishes

Built it **tight** and **VENTILATE** it right

Home Owner Guidance

- Ultimately the efficiency of the home is in the hands of the user/occupant!
- Thermostat set points and set back
- Exhaust fans
- Water use
- Water heater temp
- Changing HVAC Filters



Renewable Energy

- Step 1: Make the home as energy efficient as possible.
- Step 2: Onsite renewables

Inspection Process

- Basically same as ENERGY STAR
  - Predrywall Inspection (PDWI)
    - Visual inspection
  - Final Inspection
    - Blower Door and Duct Leakage Tests
    - Visual Inspection

NAHB Green

- ANSI approved ICC-700-2008 National Green Building Standard (NGBS)
- The Standard covers
  - Single and multifamily homes
  - Residential remodeling
  - Site development
- 1,000+ homes certified to date

NAHB Green Standard

- The Guidelines reference
  - Lot Design
  - Resource Efficiency
  - Energy Efficiency
  - Indoor Environmental Quality
  - Homeowner Education
  - Global Impact

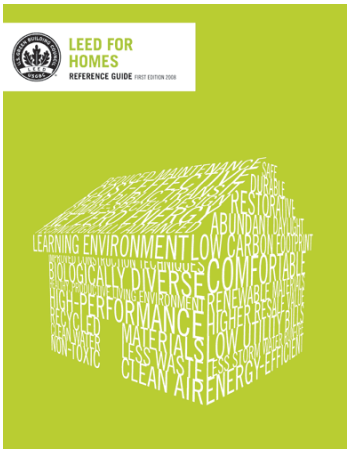
LEED for Homes

- Developed by the United States Green Building Council (USGBC)
- Pilot in 2004
- Program 2008
- 18,000 units certified to date
- 75,000 registered units

LEED for Homes

Sections

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



Why Green?

When surveyed by the National Association of Homebuilder's Research Center (NAHB-RC) in December of 2007, energy improvements topped homeowners choices for how they would spend an extra $5,000 on their new homes.

26% would pay for energy improvements

22% for new countertop

23% for other

17% for upgraded flooring

6% for upgraded appliances

5% for upgraded bathroom features

1% for new siding

Economics of Green

	Monthly	Annual
Utility Savings	$45	$540
Added Mortgage	$20	$240
Cost Savings	$25	$300

Financial Incentives

- Local utility rebates
- Local county/city incentives
- Federal energy efficient tax credit

Benefits to Builder

- Less call backs
- More desirable product
- Marketing benefits
- Differentiation in the market

Benefits to Homeowner

- Lower operating costs
- Increased comfort
- Improved environmental quality
- Enhanced durability and less maintenance
- Increased home value

Recap

We've covered…

- Green building
- NAHB Gree
- LEED for H
- EarthCraft
- Why green
- Financial in

Existing Homes

- Utility programs
- Home Performance with ENERGY STAR
- REGREEN
- EarthCraft House- Renovations
- Building Performance Institute (BPI)
- Market that supports an inspection fee or has rebates key

Home Performance with ENERGY STAR

- "National", but only where local sponsor
- ~40 programs
- Test in and Test out
- Improvement priorities list
- Financing available
- Some markets have rebates

http://www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_hpwes

REGREEN

- Developed by the American Society of Interior Designers' Foundation and USGBC
- "The nation's first green residential remodeling guidelines."
- The guidelines are free to download and are full of best practices, case studies, and other resources.

REGREEN GUIDELINES 2008

http://www.greenhomeguide.org/guide_for_green_renovation/index.html

CO Poisoning

New & Existing construction

Why do Home Performance?

- Many contractors claim taking a home performance approach improves closing rates.
- Same closing rate, but high profit percentage per job and larger sales.
- Some markets contractors offer free inspections, but have higher gross profit margins
- Prequalify customers- make sure they are aware of likely improvement costs

Benefits to Homeowner

- Lower operating costs
- Increased comfort
- Improved environmental quality
- Enhanced durability and less maintenance
- Increased home value

Resources

Advanced Energy, Raleigh, NC
www.advancedenergy.org

ENERGY STAR
www.energystar.gov

Florida Solar Energy Center (FSEC), Cocoa, FL
www.fsec.ucf.edu

National Association of Home Builders (NAHB)
www.nahbgreen.org

RESNET
www.resnet.us

Southface Energy Institute, Atlanta, GA
www.southface.org

USGBC
www.usgbc.org

KSG Kruger Sustainability Group

Thank You!

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