



BUILDING A FRAMEWORK FOR HEALTHY HOUSING

Guaranteed Performance in Affordable Housing

The ***SystemVision***® Program in North Carolina

- “Affordability is a Health Issue.”
 - Mary Jean Brown
Sept. 15, 2008

- “If it’s not energy efficient, it’s not affordable.”
 - Numerous energy geeks since the 70’s







SPEED
LIMIT
40

ONE
WAY
←

ONE
WAY
←

ONE
WAY
→

ONE
WAY
→

ONE WAY
←

ONE WAY
→

ONE
WAY
←

ONE
WAY
←

Her
World

3101
3101
4003



Background: Goal

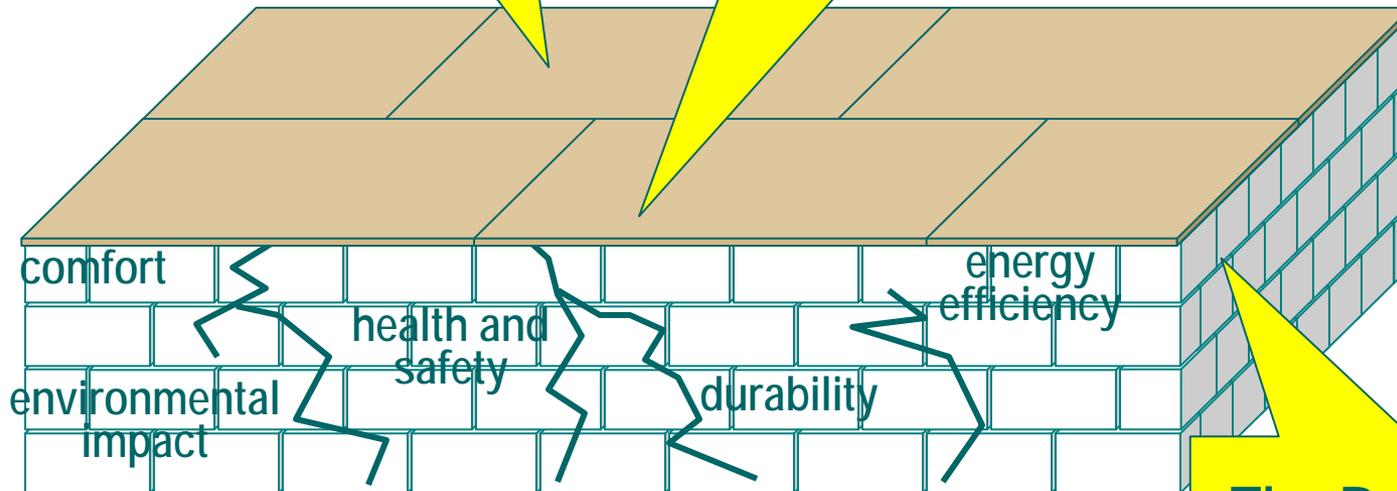
- Improve Energy Efficiency in every home receiving public or charitable funding at least to Energy Star level while **improving** home in terms of
 - Health & Safety
 - Durability
 - Comfort
 - Affordability
 - Environmental Impact



The Foundation of Good Homes

System Vision

The Building Code



The Building Code



The Building Code

- Defines the worst house allowable by law.

Anonymous Architect



Background: Goal

- Institutionalize a new base platform for affordable housing that is
- Achievable
- Cost-effective
- Not shooting for “greenest” or “healthiest” etc.



Background: Barriers Assessment

- What are the Barriers?
- 1996 Ava Kuo Study
 - Institutional
 - Monetary
 - Market
 - Knowledge (or Lack Thereof)



Barriers: Institutional

- Higher cost not reflected in higher appraisal
- Limited income buyers, even if the appraisals go up
- No energy standards for new construction required by NC Housing Finance Agency [or others]



Barriers: Monetary

- No incentive for developers/builders. No evidence that resource-efficient houses sell faster or for a premium. (in 1996!)
- Some added cost



Barriers: Market

- Market demand [for resource-efficient homes] not substantial.
- Such a pent-up demand for low-cost housing that resource efficiency is irrelevant to most buyers/renters
- If it's not a priority for buyers, it probably won't be a priority for builders.
- Some demand identified for lower utility costs; very little demand for other “green” features.



Barriers: Knowledge (or Lack Thereof)

- Learning curve can be steep on first project, leading to high costs & lots of time
- Profit margins already low in affordable housing, so there is little incentive to spend more time & money on different techniques
- Many builders take the “tried and true” approach



This is SERIOUS stuff!

CollegeHumor.com

**TOUCHING WIRES CAUSES
INSTANT DEATH**



\$200 FINE



Newcastle Tramway Authority

Overcoming the Barriers

- Extra funding from Housing Finance Agency or NC Community Development Initiative tied to
- Mandatory Standards
- Technical Assistance/QC Package
- Marketing Package



Standards

1. House Air-Tightness
2. Ventilation and Moisture Management
3. Insulation and Windows
4. HVAC Sizing and Installation
5. Pressure Balancing
6. Energy Star and Appliances
7. Combustion Safety



Standards

Or,
Energy Star
+
some basic Health & Safety



THERE is no subject directly connected with domestic life on which there is so large an amount of popular ignorance as ventilation.

...ing of all wants, he undertakes to
thers. Yet, men have been known to
e weeks, though any person wholly
most immediate and pressing of all wants, he undertakes to
supply them before all others. Yet, men have been known to
live without food for five weeks, though any person wholly
deprived of air will die in three minutes.

The want of attention to ventilation arises from the fact that the poison of breathing bad air is a slow one, and though its effects are as certain as those which follow from taking doses of prussic acid, yet they are only observed remotely, and little by little. Nature does not immediately protest against slightly impure air as against want of food and water, and, therefore, we go on from day to day, suffering the accumulated evils resulting from our ignorance, and only wondering at our want of physical health and spirits.



Technical Assistance

- Plan Review
- Contractor/Subcontractor training
- On-site quality control
- Performance testing



Testing Exhaust Fan Flow



Testing Exhaust Fan Flow



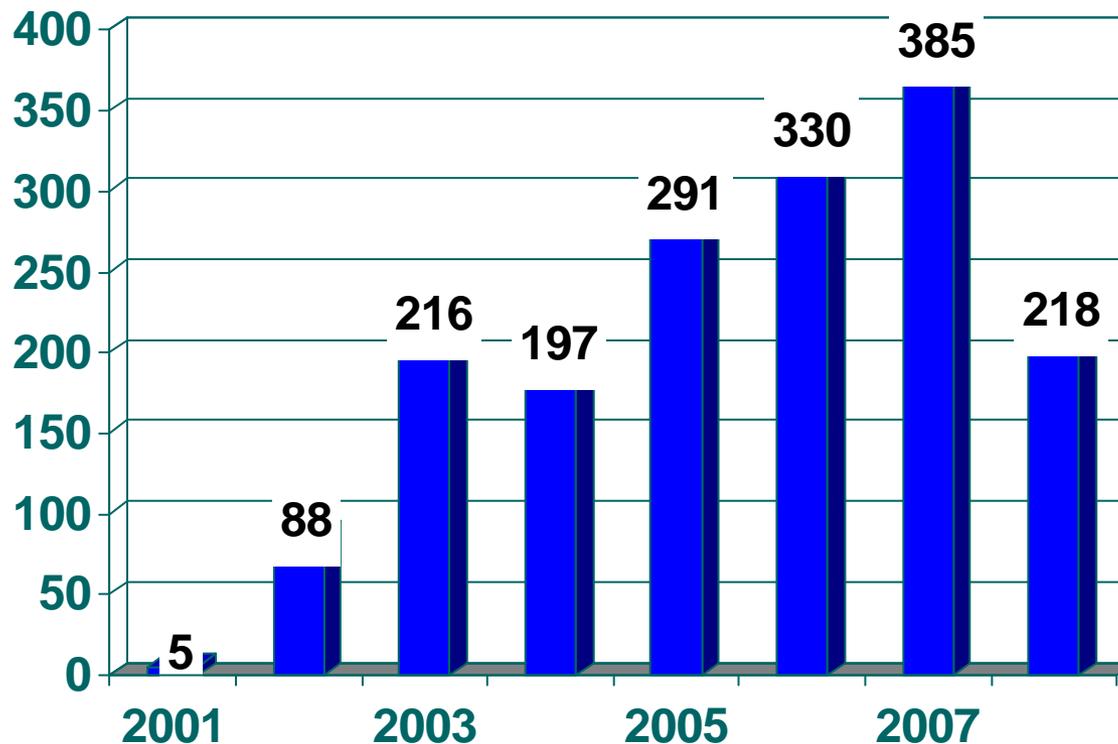


Marketing

- Training
- Certification/Guarantee
- Servicing the Guarantee



SystemVision Guaranteed Houses Annual Production



Results to Date

- 1,730 homes certified/guaranteed
- 50 counties (out of 100)



Results to Date

74 Developers

- 37 Habitat for Humanity Affiliates
- 15 Community Dev. Corporations
- 4 Local Governments
- 3 Public Housing Authorities
- 15 Other Nonprofits



Costs Too Much?

- Average Added Cost to Do System Vision:
 - \$1,500 for materials and labor for required upgrades
 - \$1,050 for plan review, training, testing guarantees, admin.
 - **TOTAL = \$2,550**



Costs too much?

- Grant from NC HFA = \$4,000
- **Net = \$1,450 for each SystemVision house!**



Costs too much?

- Avg. Added Cost: \$2,550
- = about \$15 per month on the mortgage
- Avg. savings about \$20 per month
- **Even with no grant, it's a positive cash flow for the client from day one!**



Results to Date: House Tightness CFM50/Sq. Ft. Envelope

- Benchmark NC Houses:

Median = .44

Range = .19 to 1.46

- Program Houses:

Median = .27

Range = .08 to .64

Note: 6 homes $>.44$; 81 homes (5%) $>.35$



Results to Date: Duct Tightness

Total CFM 25 / Conditioned Floor Space

- Benchmark NC Houses:

Median = 19.5%

Range = 4% to 79%

- Program Houses:

Median = 3.55%

Range = .6% to 12.7%

Note: 45 homes (3%) greater than 6% duct leakage



Results to Date: Other Factors

- Insulation: **Benchmark = 23% under code in attics**

Program: 0% under code, incl. walls

- Fresh Air Ventilation: **Benchmark = 1%**

Program = 100%

- Performance Tested Spot Ventilation:

Benchmark = 0

Program = 100%



Results to Date: Other Factors

- HVAC Sizing to Manual J :
Benchmark = 12%
Program = 100%
- Combustion Safety Tested:
Benchmark = ?
Program = 100%
- Pressure Balanced: Benchmark = ?
Program = 100%



Results to Date: Savings

- 30% of Heating & Cooling; 15% of total
- Over \$1,000,000 so far diverted from utility bills to other needs.
- Annually reducing CO₂ emissions by ~6 million pounds



Results to Date: Institutional

- NC Housing Finance Agency continues to affirm commitment in single-family housing
- Implemented program into single-family rehab
- Implemented program into all Supportive Housing
- Implemented ENERGY STAR into multi-family tax credit program



Barriers have changed

Aubra Levine, 2007

- Moving beyond the early adopters
 - Process, process, process
 - Stable funding stream
 - Competent testing infrastructure
 - Accessible oversight agency
 - Provide proven benefits to their customers



Framing Check

- All penetrations sealed with caulk,
- Windows and doors are properly sealed
- Chases are properly sealed
- All windows are properly sealed and ≤38, same as manufacturer's requirements
- Raised heel joists are installed
- Attic access is properly sealed
- Insulation at eaves is properly installed
- Backing on eaves is properly installed
- 70 CFM or greater exhaust fans are installed
- Bath exhaust fans are properly installed
- Recessed lighting is properly sealed
- Preliminary energy audit is completed
 - Pre-audit
 - No-audit
 - E-audit
- Preliminary energy audit is completed

Insulation Check

- Items from framing checklist are complete
- Baffles are installed between joists to top plate.
- No gaps, voids, or compression in insulation
- Insulation is installed to R-38
- Kraft faced batts are properly installed
- Insulation is split at eaves
- Insulation is cut at eaves
- Reliefs are cut at eaves
- Insulation is properly installed after drywall is installed
- Caulk has been used at eaves

Final Checklist

- Items from framing and insulation checklist are complete
- Home has power
- HVAC startup is complete
- Outdoor Thermostat is installed on HVAC system (heat pumps only)
- Fresh air is filtered
- Bath and kitchen exhaust fans are operational and vented
- Jump-over ducts or transfer grills are installed and doors have ¾" undercuts
- Attic hatch is insulated and weather-stripped
- 100% Ground cover is installed over crawlspace floor (crawlspace only)
- Sub-floor insulation is installed to SystemVision standards (crawlspace only)
- R-38 attic insulation is installed
- Two compact fluorescent lights are installed
- Home has Energy Star labeled refrigerator
- Home has Carbon Monoxide detector installed if applicable (see standard 7.2)

Tools

1 Apply mastic to boot
 Aplique la masilla al cuello del adaptador

AVANVED ENERGY TECH TIPS DUCT SEALING INSTALACIÓN DE AISLANTE PARA DUCTOS

BOOT CONNECTIONS
 CONEXIONES DE ADAPTADOR

BAD MAL HECHO

GOOD BIEN HECHO

2 Pull liner onto boot
 Meta el cuello del adaptador en el ducto

AVANVED ENERGY TECH TIPS AIR SEALING BLOQUEO DE ENTRADAS DE AIRE

- Insulation, other than foam, will not stop air. El único aislante que evita el paso del aire es el de espumas.
- Blocking material should be rigid. El material para bloquear debe ser rígido.
- The most important holes to seal lead to the attic and to the garage. Las perforaciones que conectan al ático y al garage tienen prioridad a la hora de bloquear entradas de aire.

BAD MAL HECHO

GOOD BIEN HECHO

SystemVision.org

6 Seal seams of boot
 Selle las uniones del adaptador por dentro

3 Air seal all plumbing penetrations
 Selle todas las perforaciones

1 Completely fill cavity
 Llene el espacio en su totalidad

2 Cut insulation to fit around obstructions
 Corte el aislante de manera que se acomode alrededor de las obstrucciones

3 Attic insulation must touch sheetrock
 El aislante para el ático tiene que hacer contacto con la tabla yeso

4 Split insulation around wiring
 Corte el aislante y acomódelo alrededor de los cables eléctricos







Guarantee for feedback

- Benefit to the home owner
 - A home that works
 - Support if it doesn't
 - Financial
 - Technical
 - Follow up education if needed



Key Learnings

- Discrete Package rather than “Chinese Menu” approach
- Technical Credibility
- Practical
- TA & Training
- QC
- Feedback



Key Learnings

- Change the Design Process
- Change the Marketing Process
- Change the Construction Process





HEATING AND COOLING
GUARANTEED
TO COST LESS THAN
\$31 A MONTH*

*Monthly amount of service based on the amount of energy used.





BUILDING A FRAMEWORK FOR HEALTHY HOUSING

High Performance Home: Mold-Safe, Moisture-Free and Energy-Efficient

Presented by Charles L. Perry, Jr.
Principal, Environmental Assurance Group
High Performance Building Innovation Center



























**BUILDING A FRAMEWORK
FOR HEALTHY HOUSING**



























High Performance Home: Mold-Safe, Moisture-Free and Energy-Efficient

Questions?





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