THE ICYNENE® ADVANTAGE
A Closer Look at Air Superiority in Action

Vol. 12, Issue 04

Application Case Study: A Custom Upgrade to Transform a 1950's Ranch into an EarthCraft House™

Synopsis:

- ✓ **Reduced air infiltration by 43%**
- ✓ **Achieved Home Energy Rating (HERS) of 87**
- ✓ **Decreased heating and cooling costs, despite the 47% increase in living space**

The Challenge – Optimizing Energy Performance While Preserving Original Architectural Details

Converting this 1950's era ranch into a two-story residence is a prime example of how a home can be transformed while retaining much of the original structure and incorporating new building technologies to meet EarthCraft House™ standards for a healthy, cost-effective home. Following EarthCraft House™ guidelines, this project was completed by SawHorse, Inc., a prominent design/build firm in Atlanta, and Glenn Cartledge, homeowner and architect. EarthCraft House™, a program of the Greater Atlanta Home Builders Association and Southface Energy Institute, is committed to assisting builders to construct healthy, comfortable, affordable homes that reduce energy and water bills while utilizing sustainable building products.

Located in Atlanta, GA, the renovation of the Cartledge residence included the addition of a second level, increasing the living space from 3,338 sq. ft. to 4,921 sq. ft. An additional bedroom was also created for a total of 4 bedrooms. The Cartledges also wanted more natural light to penetrate the home, which resulted in a 255% increase in window area (from 250 sq. ft. to 887 sq. ft.). For increased energy efficiency, the A/C system increased from 10 SEER to 12 SEER, while the furnace increased from 78.5 AFUE to 95.5 AFUE. Return and supply ducts also increased from 114 sq. ft. to 305 sq. ft. and 229 sq. ft. to 380 sq. ft., respectively. Other redesign elements included major interior renovations to the original first floor and basement levels. The first floor was gutted to the studs and fiberglass insulation was removed from the wall cavities.

Despite the increase in living space and conditioned area, the EarthCraft House™ objective was to increase energy efficiency by creating a well-insulated thermal envelope that would deliver optimal airtightness for a Healthier, Quieter, More Energy Efficient® living environment.

The Cartledge residence in Atlanta, GA was a classic 1950's style ranch. The renovation increased the size of the house to 4,921 sq. ft. from 3,338 sq. ft.

The original furnace and duct work in the house were circa 1970's. The air infiltration rate was 0.65 ACH (Air Changes per Hour) @ natural pressure. The Icynene® application reduced the rate to 0.37 $ACH_{nat.}$

THE ICYNENE® ADVANTAGE : *A Closer Look at Air Superiority in Action*

The Solution – Insulate with Icynene®

All homes allow some amount of air infiltration through gaps, holes and penetrations in the building envelope. Older houses, however, tend to be very leaky. The renovation guidelines established by EarthCraft House™ explain that an older home typically replaces all of its air once each hour.[1] However, it is recommended that air changes per hour do not exceed approximately 1/3 of the air in the home. The Icynene Insulation System® is a complete insulation and air barrier that was specified to help the builder achieve this target. Icynene® controls random air leakage to reduce the amount of air changes per hour in order to decrease heating and cooling loads on the HVAC system. Icynene® allows the home to maintain a constant, comfortable temperature and humidity level, while using less energy.

The key is to eliminate as many air leaks as possible and then introduce controlled ventilation. By minimizing random air leakage and controlling airflow, Icynene® allows for rightsizing of HVAC equipment to significantly reduce heating and cooling costs and maintain controlled humidity levels.

In order to incorporate a properly sized heating and cooling system, the design and construction of the heritage home included the following repairs and upgrades:

- R-13 of Icynene® insulation and air barrier system replaced R-13 fiberglass insulation in the first floor exterior walls.
- R-13 fiberglass insulation removed from old attic assembly.
- R-21 of Icynene® insulation and air barrier system applied to new vaulted ceiling.
- Window area increased from 250 sq. ft. to 887 sq. ft.

Icynene® was sprayed directly into the wall cavity around the HVAC system and the return and supply ducts. This helped to improve the airtightness of the building envelope and increase the overall energy efficiency.

Icynene® was applied to the underside of the vaulted ceiling in the old attic space. This turned the previously unconditioned space into a conditioned living area.

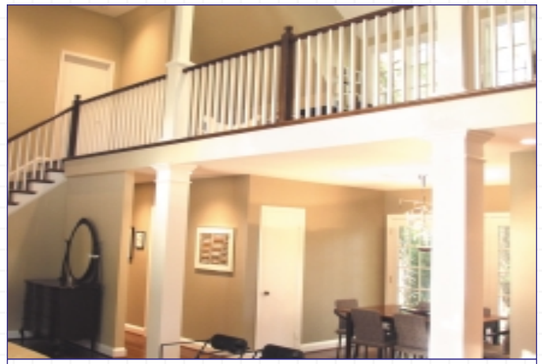
An efficient building envelope, thermal comfort and a dry, healthy living environment are all integral components of sustainable building and design. As part of the remodel of this 1950's traditional home, SawHorse, Inc. decided that the Icynene® application was the best option for this project in order to ensure that all of these components were incorporated without sacrificing the integrity of the ranch's original architectural details.

> *"After exploring various insulation systems for this project, we determined that taking advantage of Icynene®'s combined insulation and air infiltration control properties provided us with significant cost and performance advantages over conventional insulations. Other insulation options required separate air-sealing methods to meet the performance requirements for this house."*
>
> *– Carl Seville, Vice President of SawHorse, Inc.*

The Results

Fulfilling the criteria established by EarthCraft House™, the Icynene®-insulated custom home demonstrates the benefits of employing advanced building technologies and construction practices for increased energy efficiency and superior indoor air quality.

Icynene® also allows for new design strategies, according to Mr. Cartledge, "*By its nature, Icynene® requires no ventilation space from soffit to ridge, which increases design freedom for both the exterior and interior of the house. Icynene® is intended to fill all of the gaps and crevices, thus eliminating the need to leave a path for air ventilation within the rafters.*"



Icynene® allowed Mr. Cartledge the freedom to utilize new design strategies when he was creating the open concept layout. He did not need to assign additional ventilation space due to Icynene®'s air-sealing capabilities.

The Icynene®-insulated home surpassed all of the EarthCraft House™ guidelines. The Cartledges were able to decrease their heating and cooling consumption by 12% and 54% respectively.

Icynene® addresses moisture concerns by minimizing air movement through the building envelope, which accounts for 99% of moisture migration and subsequent mold and mildew problems.

Icynene® was ideal for this remodel project. It met the expectations of Mr. Cartledge, as well as those of EarthCraft House™. The following results were achieved:

- Air infiltration rate reduced from 0.65 ACH to 0.37 ACH @ natural pressure, meeting the recommendation of 1/3 air changes per hour.[2]
- Decreased heating and cooling consumption per square foot by 12% and 54%, respectively, despite the increase in conditioned space (Figure 1).
- HERS rating of 87 achieved – 10 points above the home's original HERS rating before renovation (HERS 77).
- Remodeled home exceeded the qualifications for the ENERGY STAR® label (the home is 5% more efficient than the ENERGY STAR® requirement).

FIGURE 1: ENERGY PERFORMANCE – BEFORE AND AFTER

COOLING CONSUMPTION	BEFORE (3,338 SQ. FT.) 4/11 – 10/11 2000	AFTER (4,921 SQ. FT.) 4/15 – 10/15 2002	PERFORMANCE INCREASE
Electricity consumption for cooling (kWh)[3]	2512 (with CDD*: 1888) Averaging 419kWh / mo.	1818 (with CDD*: 1924) Averaging 303kWh / mo.	54%
Estimated electricity consumed for cooling per unit area	0.13kwh / sq. ft. / mo.	0.06kwh / sq. ft. / mo.	
HEATING CONSUMPTION	**BEFORE (3,338 SQ. FT.) 10/2000 – 3/2001**	**AFTER (4,921 SQ. FT.) 10/2002 – 3/2003**	**PERFORMANCE INCREASE**
Natural Gas consumption data for heating (CCF)[4]	503 (with HDD*: 2922) Averaging 84ccf / mo.	651 (with HDD*: 2895) Averaging 109ccf / mo.	12%
Estimated gas consumed for heating per unit area	0.025ccf / sq. ft. / mo.	0.022ccf / sq. ft. / mo.	

* *CDD – Cooling Degree Days relate the day's temperature to the demand for energy to cool buildings. Along with utility bills, records of past cooling degree days are utilized to see if the money spent on insulation or a new air conditioner has paid off.*
* *HDD – Heating Degree Days relate the day's temperature to the demand for fuel to heat buildings. In correspondence with utility bills, records of past heating degree days are utilized to see if the money spent on insulation or a new furnace has paid off.*

The high-performance insulation solutions offered by The Icynene Insulation System® allowed SawHorse, Inc. to achieve optimal airtightness levels and maximum energy efficiency. In one step, the spray foam insulation and air barrier sealed all gaps and crevices that compromised airtightness.

THE ICYNENE® ADVANTAGE

A Closer Look at Air Superiority in Action

Vol. 12, Issue 04

Minimizing random air leakage in the home can also minimize the amount of pollen, dust, radon, humidity, mold and other contaminants that can threaten the quality of the occupants' breathing space. The result is a healthier, more energy efficient living environment.

Icynene® Performance in a Remodel Project:

- ✓ **Offers freedom in architectural design and construction**
- ✓ **Minimizes air leakage and allows for HVAC equipment rightsizing**
- ✓ **Increases energy efficiency, despite increased living space**
- ✓ **Provides a retrofit while preserving the home's original architectural details**

The Icynene Insulation System®

Icynene® is a low-density soft foam insulation, which is sprayed into/onto walls, crawlspaces, underside of roofs, attics and ceilings by Icynene Licensed Dealers. Sprayed as a liquid, it expands to 100 times its volume in seconds to create a superior insulation and air barrier. Every crevice, crack, electrical box, duct and exterior penetration is effortlessly sealed to reduce energy-robbing random air leakage. Icynene® adheres to the construction material and remains flexible so that the integrity of the building envelope seal remains intact over time.

Icynene® is ideal for residential, commercial, industrial and institutional indoor applications. The product is:

Healthier: Water is the only blowing agent. Icynene® contains no HCFCs, HFAs, HFCs, formaldehyde or volatile organic chemicals. It seals out dust, pollen and other allergens from entering the structure. As an air barrier, Icynene® minimizes the potential for condensation and the subsequent mold and mildew.

Quieter: By sealing the building envelope, Icynene® effectively minimizes airborne sounds. Icynene® is perfect for reducing unwanted noises from home theaters, plumbing runs, street traffic and playrooms.

More Energy Efficient: Icynene® delivers up to 50% energy savings versus traditional insulation.

Information about The Icynene Insulation System® can be obtained by calling Icynene Inc. (800-758-7325), visiting the website **www.icynene.com**, or contacting your local Icynene Licensed Dealer.

Endnotes:

1. *EarthCraft House™ Renovation Guidelines: http://www.southface.org/home/ech/ECH-renovation_guidelines-7-16-03.pdf*
2. *Icynene® routinely meets an air leakage level of 0.1 ACH_{nat} when applied to whole buildings*
3. *Electricity consumption data as recorded by Georgia Power Company*
4. *Natural Gas consumption data as recorded by Scana Energy*

The Icynene Insulation System®

Healthier, Quieter, More Energy Efficient®

For more information, contact your local Icynene Licensed Dealer:

Visit our website: www.icynene.com
or call
1-800-758-7325