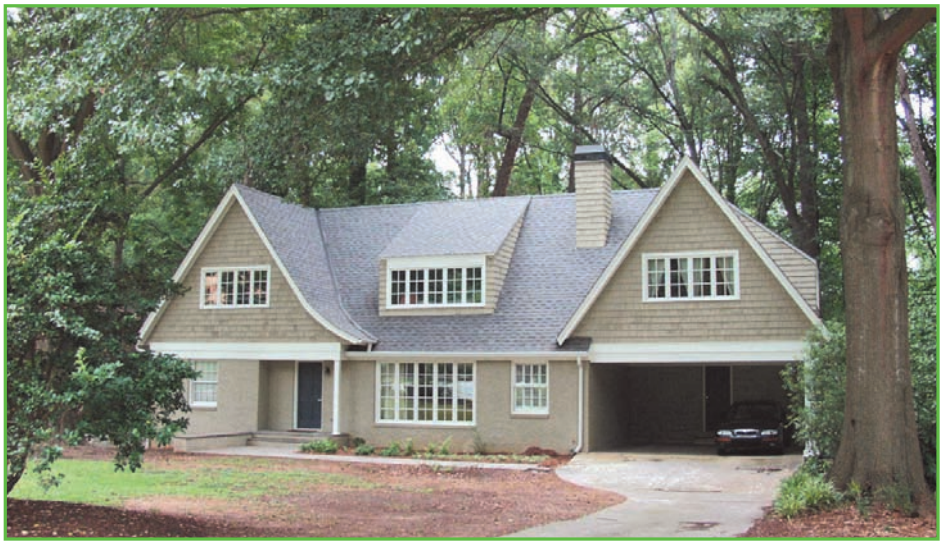
ICYNENE™
HEALTHIER, QUIETER, MORE ENERGY EFFICIENT®

THE ICYNENE® ADVANTAGE

APPLICATION CASE STUDY:

A Custom Upgrade to Transform a 1950's Ranch into an EarthCraft House™



Synopsis:

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

(Note: all references to the HERS index in this case study reflect the original rating system. HERS changes have taken effect January 2007. These changes are outlined in the footnote on pg. 2)

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 cut energy and water bills while utilizing sustainable building products.

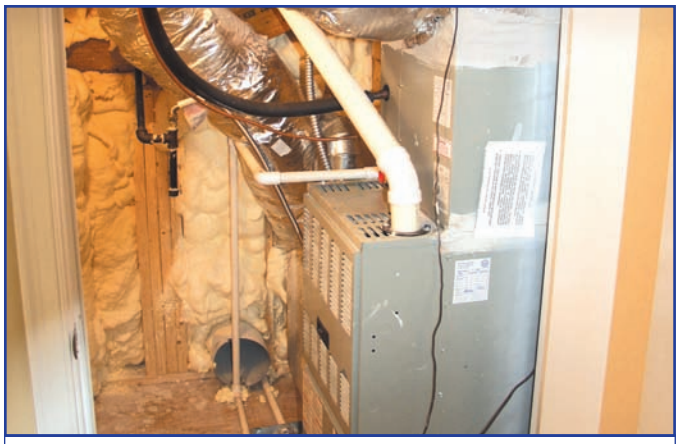
The Cartledge residence in Atlanta, GA was a classic 1950's style ranch. The renovation increased the size of the house to 4,921 sq. ft. from 3,338 sq. ft.

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 LD-C-50™† application reduced the rate to 0.37 $ACH_{nat.}$

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.). 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.

HERS Update:

Prior to January 2007, the HERS index was based on the 1993 Model Energy Code where the "code" home score was 80. Every 5% reduction in total energy consumption achieved 1 point with 100 being the best possible score. To meet Energy Star® requirements, a home needed to be 30% more efficient than the model energy code (equivalent of HERS 86). Under the new system (in effect January 2007), the HERS index is based on the 2004 International Energy Conservation Code where the "code" home score is 100. For every 1% reduction in total energy consumption, the HERS index is lowered by 1 point. Under this system, a zero-energy home would score 0. To meet new Energy Star® requirements, a home in a cold climate needs a HERS index no higher than 80 (20% more efficient than the reference home). In moderate or hot climates, an index no higher than 85 is required. Visit Energystar.gov for complete details.



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.

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 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™ explains 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. Icynene is a complete insulation and air barrier that was specified to help the builder achieve this target. Icynene controls 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 using less energy.

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

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 foam insulation and air barrier 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 applied to new vaulted ceiling
- Window area increased from 250 sq. ft. to 887 sq. ft.
- Return and supply ducts increased from 343 sq. ft. to 685 sq. ft. in total

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 are 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 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:

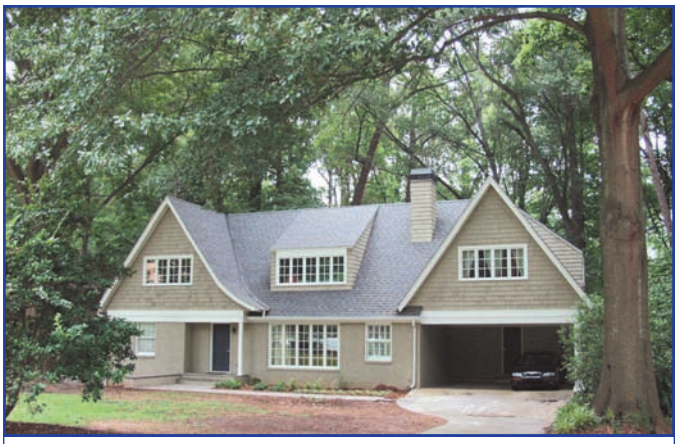
- Air infiltration rate reduced from 0.65 ACH to 0.37 ACH @ natural pressure, meeting the recommendation of 1/3 air changes per hour. [2]
- Decreased heating and cooling consumption by 12% and 54%, respectively, despite the increase in conditioned space (Figure 1).
- HERS rating of 87 achieved – 10 points 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.*

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.

The high-performance insulation solutions offered by Icynene 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.

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

Icynene Insulation

Icynene foam insulation products are sprayed into/onto walls, crawlspaces, underside of roofs, attics and ceilings by Icynene Licensed Dealers. They expand in seconds to create superior insulating and air-sealing results. Every crevice, crack, electrical box, duct and exterior penetration is effortlessly sealed to reduce energy-robbing random air leakage. Icynene products adhere to the construction material and remain 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 products are:

Healthier: Icynene spray foam products are CHPS (Collaborative for High Performance Schools) EQ 2.2 Section 01350 Compliant, meeting nationally recognized requirements as Low-Emitting Materials (LEM) and Environmentally Preferable Products (EPP). Icynene spray foam products are 100% water-blown and contain no HFCs or PBDEs. Icynene seals out dust, pollen and other allergens from entering the structure. As air barriers, Icynene products minimize the potential for airborne moisture build-up and related problems such as mold and mildew.

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

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

Information about Icynene insulation can be obtained by calling Icynene Inc. (800-758-7325), visiting the website Icynene.com, or contacting your local Icynene Licensed Dealer.

† The Icynene product installed and addressed in this project example is Icynene's classic formula, ICYNENE LD-C-50™.

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 ACH₅₀ 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*

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For more information, contact your local Icynene Licensed Dealer

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

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