



ICYNENE™

HEALTHIER, QUIETER, MORE ENERGY EFFICIENT*

THE ICYNENE® ADVANTAGE

APPLICATION CASE STUDY: LEAN, CLEAN AND GREEN – Achieving Superior Energy Efficiency and A Healthier Indoor Environment Using Less Construction Material In A Custom Home Project



Synopsis:

- ✓ Exceeded the Summerset community performance standards with a HERS score of 91 – five points above the minimum requirement of HERS 86
- ✓ Achieved 1.1 air changes per hour (ACH) at 50 Pascals (Pa), far exceeding the Summerset community performance standards of 4.0 ACH at 50 Pa
- ✓ Created an airtight envelope in one step with no duct leakage to the outside
- ✓ Proved to be the most cost-effective insulation option by reducing extra construction costs, equipment costs and utility costs
- ✓ Improved Indoor Air Quality

(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:

For more than 50 years, Summerset at Frick Park, located in Pittsburgh, PA, was used by the area's steel mills as a dumping area for slag – a by-product of the steel-making process. Pittsburgh's Urban Redevelopment Authority (URA) determined the site to be environmentally safe and suitable for development and allocated approximately \$30 million for site preparation and cleanup. In collaboration with the city of Pittsburgh, Building America's IBACOS Consortium and four builders have been given the challenge of transforming the former industrial dump into a showcase for Pittsburgh's revitalized east side – the city's largest residential development since WWII. The new development consists of 710 single-family homes, townhomes and luxury apartments on 238 acres overlooking the Monongahela River.

Working closely with IBACOS, Roger Glunt, President of Jayar Construction Co., Inc., was responsible for building a 7,700 square-foot, single-family custom "Estate Home" at the Summerset community. The home was to abide by the performance standards established by the Summerset community and reflect cost-effective measures. These standards include:

- 30% energy reduction versus the Model Energy Code, which is equivalent to a HERS score of 86.
- An airtight envelope that cannot exceed 4.0 ACH @ 50 Pa.
- An air distribution system that hinders duct leakage to the outside of the house.

Jayar Construction was also interested in implementing a new approach to minimize the potential for condensation-related mold growth resulting from air infiltration/exfiltration. Improving the building airtightness was vital in order to minimize air leakage and reduce the possibility of condensation occurring in the thermal envelope of the building. An emphasis on airtightness was also important in achieving the primary objective of increased energy efficiency.

The Solution – Insulate with ICYNENE LD-C-50™†:

Jayar Construction was dedicated to meeting the Summerset community performance standards and providing exceptional quality and performance for the owner of this premium custom home. In response, IBACOS recommended high-performance insulation solutions that exceeded these requirements.

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](http://energystar.gov) for complete details.



Installed by U.S. Spray Systems Inc., Icynene solved a number of issues that were raised when fiberglass was being considered for this project:

Garage Walls and Ceiling

- R-18 (5 inches) of Icynene was installed in the walls and ceiling of the garage so as to provide a protective thermal and air barrier to the adjoining interior living space.

Cathedralized Attic System

- R-18 (5 inches) of Icynene was installed on the underside of the roof deck so the attic space became part of the conditioned envelope of the house. This approach was necessary in order to accommodate the HVAC system design, which required the system to be located within the conditioned space.

Exterior Walls

- R-12 (3.5 inches) of Icynene was sprayed into the first and second story exterior wall cavities of the home.

Basement Finished Walls

- R-12 (3.5 inches) of Icynene was installed on the inside of the finished exterior basement walls and R-18 (5 inches) was sprayed in the band joists in the basement area. As an insulation and air barrier, Icynene minimizes the potential for warm, moist air to move through the building envelope and contact cooler surfaces.



Areas that are considered difficult to insulate with conventional insulations are no obstacle for Icynene. Cathedralized attics and gradient kitchen ceilings can be quickly and easily insulated.



Incorporated with a properly sized HVAC system, Icynene minimizes the potential for condensation and mold growth when it is applied to the underside of the attic roof deck.

The Results:

INCREMENTAL COST SAVINGS

Insulating and air-sealing in one step, Icynene helped Jayar Construction achieve an airtightness level of 1.1 ACH @ 50 Pa (far exceeding the performance standard of 4.0 ACH @ 50 Pa). By building tight and introducing mechanical ventilation, the Summerset Estate Home will use less energy to heat and cool, allowing for rightsizing of the mechanical system. Downsizing the HVAC equipment enables Jayar Construction to offer the homebuyer initial savings in equipment costs and ongoing savings in utility costs, making the better long-term investment.



The following demonstrates the resources required to create a tighter building envelope in accordance with the Summerset community performance standards, comparing Icnene and a conventional insulation material.

Building Components: Comparative Analysis

REQUIREMENTS FOR ACHIEVING PERFORMANCE STANDARDS	ICYNENE	FIBERGLASS BATT INSULATION
Air Infiltration rate	1.1 ACH @ 50 Pa	4.0 ACH @ 50 Pa
Sealing Material and Labor Costs	\$200.00	\$1,900.00
HVAC Equipment & Installation Costs	\$24,905.40	\$25,173.40
Energy Costs ¹	\$1,343.00/yr	\$1,569.00/yr

Benefits for Jayar Construction and prospective homebuyers:

- ✓ \$1,968 saved during construction (associated air-sealing and HVAC costs)
- ✓ superior air-seal achieved without the need for labor-intensive air-sealing material
- ✓ energy savings of almost \$20/month
- ✓ reduced callbacks that would otherwise result from air infiltration: drafty areas, cold spots, high humidity levels, and airborne moisture (and related mold/mildew problems)
- ✓ builder can sell Healthier, Quieter, More Energy Efficient® homes

UNPRECEDENTED TEST RESULTS

Four blower door tests were conducted during the construction process, which served to assess the air sealing capabilities of Icnene.¹ Total reduction in airflow @ 50 Pa across the building envelope from the initial test to the final test was 4943 CFM @ 50 Pa – 93% of which was accomplished by applying Icnene to the open cavities, 3% by caulking and sealing top and bottom plates, and the other 4% from installing drywall.



Icnene softly expands to 100 times its initial volume to completely fill all gaps and crevices that compromise airtightness.



A blower door test was conducted to measure airflow, which proved that the most significant reduction in airflow was the result of the Icnene application alone.



BLOWER DOOR TEST STAGES (FROM ICYNENE APPLICATION)	AIRFLOW REDUCTION (@ 50Pa)
Post-Icynene (after installation of exterior sheathing & face brick; before drywall was installed) – Once Icynene was applied to exterior surfaces, this test indicated that Icynene provided the most significant barrier to airflow across the building envelope.	93%
Post sealing of top and bottom plates of stud walls – This test identified only a slight difference from the last stage (Icynene application).	3%
Final test: finished condition (after the installation of drywall and door hardware, etc.) – This offered the most surprising results since the installation of drywall reduced airflow by only 223 CFM @ 50 Pa.	4%

In summary, this series of tests demonstrated the following:

- Icynene provided a significant barrier to airflow across the building envelope, even before the installation of drywall;
- Labor-intensive caulking of top and bottom plates resulted in a relatively small reduction in airflow once Icynene had already been applied;
- Even the installation of drywall and finishing trim resulted in a minimal reduction in airflow once Icynene had already been applied.

IMPROVED CONSTRUCTION PROCESS

Selecting Icynene allowed Jayar Construction to build a Healthier, Quieter, More Energy Efficient® Estate Home. With less material and a more rapid construction process, Jayar Construction was astounded with their achievement in surpassing the community’s standards and obtaining unmatched results using Icynene;

“The Summerset homes are designed and engineered to excel in quality and comfort. Given [the Summerset community’s] target energy efficient goals, our decision to build our houses with Icynene was very easy. Icynene seals our homes better than any other product or series of products and helps us exceed the energy efficient goals without having to worry about time-consuming callbacks that delay our schedule.”



R-18 is sprayed into the rim joists of the basement area to prevent warm, moist air from coming into contact with cooler wall services, minimizing the potential for condensation.



Icynene adheres to common construction materials and maintains its efficiency with no loss of R-value over time. Icynene does not shrink, sag or settle.



Icynene also allowed for quick and easy applications in areas that would have been otherwise difficult to insulate with batts, such as the cathedralized attic and gradient kitchen ceiling.

Icynene in a Custom Residential Project Application:

- ✓ Achieved optimal airtightness of 1.1 ACH @ 50 Pa, surpassing the Summerset community standards of 4.0 ACH @ 50 Pa
- ✓ Scored a HERS rating of 91, which translates to 55% energy reduction versus the 1993 Model Energy Code, far exceeding the 30% requirement (HERS 86).
- ✓ Increased building productivity since the homebuilder attained optimal airtightness in one step and with one Icynene application
- ✓ Labor-intensive caulking of top and bottom plates only accounted for a 3% reduction in airflow, while a 93% reduction was accomplished by applying Icynene to the open cavities
- ✓ Sealing materials amounted to \$200.00 with the Icynene application, which is \$1,700.00 less than if the house was insulated with fiberglass batts
- ✓ Homeowner realized additional savings in HVAC equipment installation and operating costs
- ✓ Two HVAC units were installed in conditioned-spaces –one in the basement serving the basement and first floor, and one in the attic serving the second floor and third floor loft spaces.

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. Blower door tests were conducted by a Certified Home Energy Rater (certification 2002 by the Energy and Environmental Ratings Alliance).
2. REM/Design – Residential Energy Analysis Software v10.21

Fuel/Component	Icynene	Fiberglass Batt	Difference
Heating	\$1,231.00	\$1,460.00	-229
Cooling	\$ 112.00	\$ 109.00	3
HVAC	\$1,343.00	\$1,569.00	-226



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