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

Vol. 12, Issue 03

Application Case Study: Lean, Clean and Green

Synopsis: Achieving superior energy efficiency and a healthier indoor environment using less construction material in a custom home project

- ✓ **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**

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.

With the Icynene® application, this 7,700 sq. ft. custom home exceeded the Summerset community's energy performance standards, resulting in initial savings of HVAC equipment costs and ongoing savings of utility costs.

Icynene® is installed by an Icynene Licensed Dealer to facilitate the construction process, allowing the builder to build a durable, airtight envelope with less sealing material.

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®

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.

Installed by U.S. Spray Systems Inc., The Icynene Insulation System® 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 rim joists in the basement area. As an insulation and air barrier, Icynene® minimizes the potential for warm, moist interior air from coming into contact with cooler wall 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

Initially, the cost of The Icynene Insulation System® was more than what the builder expected to pay for fiberglass batt insulation (as illustrated in the analysis on the following page). However, Jayar Construction realized quantifiable savings by eliminating sealing materials and labor that would have been required if fiberglass was used to construct a high-performance thermal envelope, meeting the performance standards of 4.0 ACH @ 50 Pa (versus Icynene®'s final result of 1.1 ACH @ 50 Pa).

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The Icynene Insulation System®		Fiberglass Batt Insulation	
Building Components	**Cost**	**Building Components**	**Cost**
Icynene®	$12,625.00	Fiberglass batts	$6,400.00
Sealing material and labor	$200.00	Sealing material and labor	$1,900.00
HVAC equipment and installation cost	$24,905.40	HVAC equipment and installation cost	$25,173.40
Icynene® System (1.1 ACH @ 50 Pa)	$37,730.40	Fiberglass System (4.0 ACH @ 50 Pa)	$33,473.40

Difference: $4,257 – only 13% more than a premium fiberglass package

The price of material alone appeared to demonstrate a significant cost differential. However, further analysis proved this price gap to be inaccurate. Once the homebuilder considered all other costs associated with constructing the airtight thermal envelope with proper mechanical ventilation, the difference became minimal. Icynene® provided a complete air barrier without the excess sealing material. It reduced heating and cooling loads and, as a result, allowed for rightsizing of the mechanical system. Furthermore, the Icynene® application resulted in initial savings of equipment costs and ongoing savings of utility costs. A residential energy analysis indicates that annual HVAC operating costs for the Icynene®-insulated home with an airtightness of 1.1 ACH @ 50 Pa is $1,343.00. This amount would have escalated to $1,569.00 had the home been insulated with fiberglass batts.

Aside from cost savings, an Icynene®-insulated home provides optimal airtightness to ensure a healthier indoor environment by sealing out dust, allergens, odors and pollutants. The Icynene Insulation System® is the most rewarding option because it continues to maintain its efficiency with no loss of R-value over time. Icynene® will continue to act as a complete air barrier and provide total comfort for its occupants today and for years to come.

Unprecedented Test Results

Four blower door tests were conducted during the construction process, which served to assess the air sealing capabilities of The Icynene Insulation System®.[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 Icynene® to the open cavities, 3% by caulking and sealing top and bottom plates, and the other 4% from installing drywall.

Blower Door Test Stages (From Icynene® Application)	Airflow Reduction (@ 50 Pa)
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%

iority in Action

Icynene® 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 Icynene® application alone.

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 durable and airtight building envelope without the use of labor-intensive sealing material (as would have been required with the installation of fiberglass batts for this project). Jayar Construction increased building productivity since the construction process did not have to be altered to accommodate callbacks to attain the airtightness requirement of 4.0 ACH at 50 Pa. The final result of 1.1 ACH @ 50 Pa was achieved by U.S. Spray Systems, Inc. with just one installation of The Icynene Insulation System®.

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 The Icynene Insulation System® 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.*"

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.

Quantitative Analysis

In accordance with the Summerset community performance standards, Icynene® rose to the challenge:

- Blower door test data confirmed a rating of 1.1 ACH at 50 Pa.
- HERS score of 91 was achieved, which translates to 55% greater efficiency versus the Model Energy Code, far exceeding the 30% requirement (HERS 86).
- HVAC operating costs for heating and cooling the home amounted to $1,343.00, which is $226.00 less than the cost of heating and cooling this home had it been insulated with a premium fiberglass package and had met the requirement of 4.0 ACH @ 50 Pa.[2]
- Reduced heating and cooling loads allowed for rightsizing of the mechanical system, rendering a $1,000.00 savings, plus an additional $500.00 due to the elimination of a ridge vent (HVAC equipment and installation cost thereby amounting to $24,905.40).
- 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 the third floor loft spaces.

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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® 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 surpassed the Summerset community standards of 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**

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. The Icynene Insulation System® adheres to the construction material and remains flexible so that the integrity of the building envelope seal remains intact over time.

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

Healthier: Water is the only blowing agent. Icynene® contains no CFCs, 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, roads 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. *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*

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