

Build High-Performance Homes.  
Build Your Business.



With COMFORT FOAM® residential insulating air barrier  
using Honeywell Enovate® zero-ozone-depleting  
blowing-agent technology.

**Honeywell**



BASF Polyurethane Foam Enterprises LLC

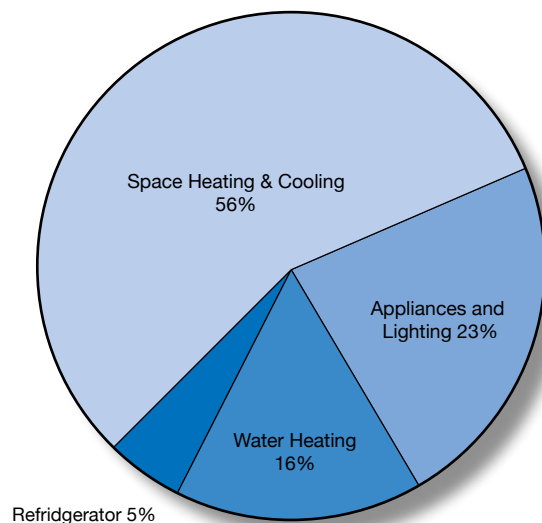
# The Importance of High Performance



Public awareness of the environment, energy consumption and climate change has never been higher. Is it any wonder the demand for sustainable housing is also growing?

High-performance homes can help you differentiate your product and build your business – even when the housing market is soft. Why? Because the high-performance home gives its owner more. More comfort. More durability. A healthier indoor environment. Lower energy bills.

But if you plan to build high-performance homes, insulation is not enough. A high-performance home needs a high-performance residential engineered building envelope system.



# The Role of the Building Envelope



The building envelope separates the interior living space from the exterior elements. Comprised of the foundations, walls and roof, its job is to keep the occupants and their possessions safe.

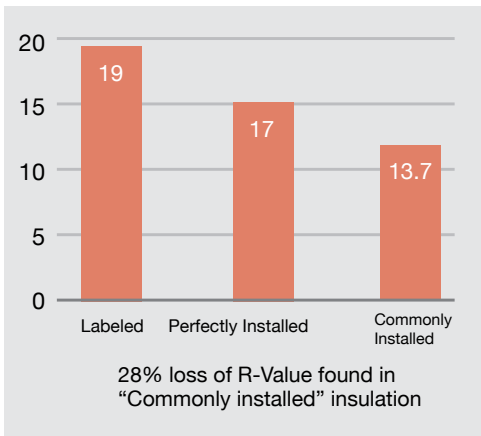
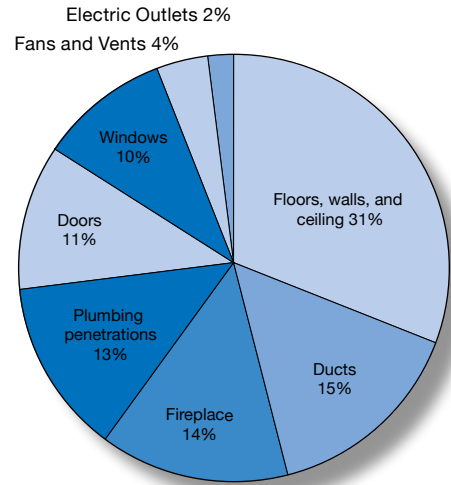
The residential engineered building envelope does more. Most conventional envelope systems allow significant amounts of conditioned air to escape through cracks, gaps and holes. In fact, the United States Department of Energy estimates that more than 40 percent of the average energy bill is wasted by uncontrolled air leakage. It also undermines thermal performance and occupant comfort.

When air travels through faulty building envelopes, it takes moisture along for the ride. In northern climates, when the warm, moist

air from inside the home meets the cooler outdoor conditions, it condenses, creating moisture problems within the wall that can lead to mold or the early deterioration of structural materials. For southern climates the reverse is true – warm, humid outdoor air infiltrates the home and condenses when it meets the cooler, conditioned indoor space – but the results are the same. Moisture damage and mold.

The residential engineered building envelope system – COMFORT FOAM® closed-cell, spray-applied polyurethane foam using Enovate® zero-ozone-depleting blowing-agent technology – creates a single continuous insulating air barrier from the foundations, up the wall and across the roof. It virtually eliminates uncontrolled air leakage while providing superior insulation performance.

# Optimal Comfort



Everyone wants to be comfortable in their home – snug and cozy in the winter, cool and crisp in the summer. The residential engineered building envelope system helps ensure a consistent indoor temperature. Occupants get to set the thermostat and think about more important things. And that lets you improve your customer satisfaction rating.

By stopping uncontrolled air leakage, COMFORT FOAM technology eliminates the cold drafts and uneven temperatures that result in so many comfort complaints and call backs.

Correct humidity levels are maintained in every climate through the elimination of air infiltration and condensing surfaces by providing a combination of near-zero air permeability and an insulation R-value of more than six per inch.

# Increased Durability



You'll sell more homes when you have a reputation for building the best quality with the lowest maintenance requirements. Moisture poses the biggest threat to structural integrity and durability<sup>ii</sup>. Our building envelope system is engineered to last for the next generation – or ten. By controlling air movement and eliminating condensing surfaces, ice damming and moisture damage are things of the past.

The engineered building envelope is proven to provide increased structural strength. Studies conducted by the National Association of Homebuilders (NAHB) show

that closed-cell foam insulation significantly increases rack and shear resistance – making homes two to three times stronger than traditional construction.

Closed-cell foams like the COMFORT FOAM insulating air barrier system are approved by the Federal Emergency Management Agency (FEMA) for flood-prone regions<sup>iii</sup>. In a flood, closed-cell foam resists water, helping to protect the wall system and building interior from damage that can include structural deterioration, rotting of building materials and, eventually, mold infestations.

# Healthier Homes Reduce Liability



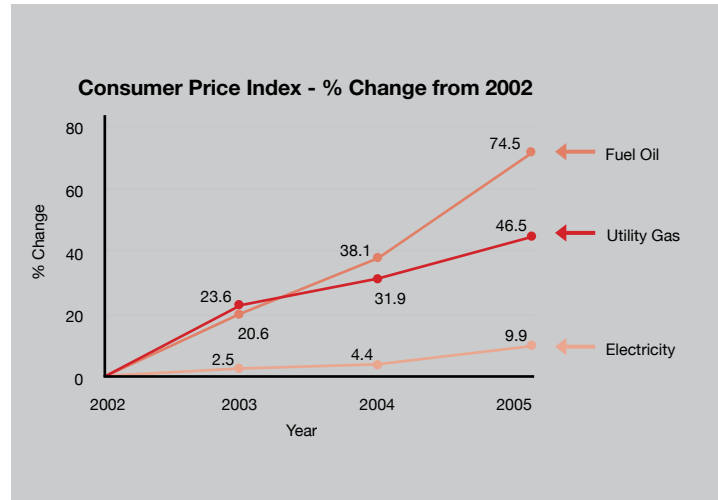
Mold is in the news and in the courts. A single case can ruin your reputation or even bankrupt your business. The residential engineered building envelope helps prevent mold by controlling air migration and eliminating condensing surfaces. COMFORT FOAM technology also provides no food source for mold.

The American Lung Association HealthHouse® guidelines recommend that houses be made airtight to improve indoor air quality and prevent

mold<sup>iv</sup>. By providing a seamless, monolithic air barrier, the residential engineered building envelope keeps allergens, toxins and pollutants out of the house, letting occupants breathe easier.

And of course, by providing a more comfortable indoor environment and reducing maintenance needs, the engineered building envelope helps occupants reduce stress and enjoy more of their home time doing the things they love with complete peace of mind.

# Maximize Energy Efficiency



The average American homeowner was spending \$1,700 a year on energy before prices began to rise so drastically. By combining superior insulation performance with complete air leakage control, the residential engineered building envelope pays for itself in energy savings – to the tune of \$600 or even more than \$1,000 a year!

Traditional insulation materials also lose some of their effectiveness to convection looping – air moves around and inside the boards or batts. COMFORT FOAM insulating air barrier systems

are spray-applied. They expand (like shaving cream) and fill every gap, crack and hole so no air can sneak around or through the insulation, which is adhered completely to the wall, roof or foundation with no room for air to circulate in the cavity.

Controlling air leakage and providing optimal thermal performance means lower HVAC requirements. Savings can be found right from the design stage by specifying a smaller, more efficient furnace and air conditioning system.

# High-Performance Means Greater Value



Although many builders concentrate on selling aesthetic upgrades, a recent survey found that home buyers are willing to invest in high performance<sup>v</sup>. Increased structural strength, improved comfort, energy savings, mold prevention and improved indoor air quality were all areas respondents listed as priorities.

The residential engineered building envelope pays for itself in energy savings. For an added \$20 to each monthly mortgage payment, the

homeowner can save \$60 a month – that's \$40 every month that can go toward other living expenses, entertainment or even for paying for those aesthetic upgrades!

Reduced HVAC requirements, optimized framing, increased structural strength and the less tangible benefits of comfort, health and safety maximize resale value down the road, making the residential engineered building envelope a smart investment today and in the future.

# Sell Environmental Responsibility



The fate of the planet is in the public eye. From hybrid cars to organic foods, consumers are buying based on environmental impact.

The residential engineered building envelope system is an environmentally-responsible choice – COMFORT FOAM closed-cell polyurethane foam using the Enovate zero-ozone-depleting blowing-agent from Honeywell.

Approved by the Environmental Protection Agency under its Significant New Alternatives Program (SNAP), Enovate HFC-245fa, does not harm the ozone layer, has low global warming potential scores and is non-flammable.

The award-winning BASF Eco-Efficiency Analysis methodology assesses total cost and ecological

impact over the product lifecycle to benchmark current performance and get insight for future improvements. Closed-cell polyurethane foam outperformed traditional systems on its test scores.

COMFORT FOAM insulating air barrier systems offer increased home energy efficiency, reducing fossil fuel usage. It also takes around 3.4 trillion BTUs less energy to manufacture every year than traditional insulation materials. It is formaldehyde-free and does not emit Volatile Organic Compounds (VOCs). Because it is spray-applied on the job site, it uses less transportation fuel and creates less waste. Due to its inherent structural strength, it also supports advanced framing techniques that use less lumber.

# Builder ROI Summary



Sustainability in the residential sector is expected to increase rapidly in coming years<sup>vi</sup>. Many jurisdictions are mandating increased performance levels for homes. Builders who can meet and exceed these performance criteria have a chance to move ahead of their competitors while also benefiting from incentives under the Federal Energy Policy Act of 2005.

The residential engineered building envelope system also helps improve your productivity by giving you two integral systems – insulation and air barrier – in one for a much faster installation. An average crew can complete a house in less than a day, providing a substantial reduction in labor costs.

Perhaps most importantly, these technologies can help reduce call-backs and comfort complaints, keeping crews moving forward to the next project and improving overall productivity.

# Computer-generated models of floor plans and energy usage

- All Models:**
- Compares the space-conditioning energy and equipment sizing for a standard home with a home insulated and air-sealed with BASF high-density spray polyurethane foam.
  - Models #1 and #2 air-sealed to 2.5 in<sup>2</sup> per 100 f<sup>2</sup> of envelope area, and ventilated to ASHRAE 62.2 [7.5 \* (# of bedrooms +1) +.01 \* CFA].
  - Model #3 air-sealed to 0.5 in<sup>2</sup> per 100 f<sup>2</sup> of envelope area, combined with batt insulation to Code-required R-value and ventilated to ASHRAE 62.2 [7.5 \* (# of bedrooms +1) +.01 \* CFA].

<b>MODEL #1</b>		■ Two-story floor plan in Chicago, IL (cold climate) with envelope surface area of 10879f <sup>2</sup> . ■ Utility Rates: 10 cents/kW and .50/therm. Heat set to 71°F and cooling set to 76°F.	
<b>Categories</b>	<b>Standard Home: (.75ach)</b>	<b>BASF Home</b>	<b>Savings &amp; Benefits</b>
<b>R Values:</b>	<b>Fiberglass:</b>	<b>Total:</b>	<b>Increase:</b>
Ceiling	R-38	R-44	R-6
Walls	R-13	R-18	R-5
Frame Floors	R-30	R-40	R-10
Space Heating: Units	330.4 MBtu	210.0 MBtu	-120.4 MBtu
Space Heating: Cost	\$1648	\$1048	-\$600
Space Cooling: Units	Units: 7.8 MBtu	Units: 9.8 MBtu	+2 MBtu*
Space Cooling: Cost	Cost: \$228	Cost: \$288	+\$60*
Heat & Cool cost/MONTH	\$156	\$111	-\$45
Heat & Cool cost/YEAR	\$1876	\$1336	-\$540
Design load: Heating	129.1	88.5kBtu/hr	-40.6 kBtu/hr (-31%)
Design load: Cooling	64.6	42.1 kBtu/hr	-22.5kBtu/hr (-35%)

<b>MODEL #2</b>		■ Two-story floor plan in Madison, WI (cold climate) with envelope surface area of 17747f <sup>2</sup> . ■ Utility Rates: 10 cents/kW and .50/therm. Heat set to 71°F and cooling set to 76°F.	
<b>Categories</b>	<b>Standard Home: (.75ach)</b>	<b>BASF Home</b>	<b>Savings &amp; Benefits</b>
<b>R Values:</b>	<b>Fiberglass:</b>	<b>Total:</b>	<b>R-Value Increase:</b>
Ceiling	R-50	R-62	R-12
Walls	R-19	R-25	R-6
Frame Floors	R-13	R-13	R-0
Space Heating: Units	674.2 MBtu	388.5MBtu	-285.7 MBtu
Space Heating: Cost	\$3364	\$1938	-\$1426
Space Cooling: Units	15.1 MBtu	20.2 MBtu	+5.1 MBtu*
Space Cooling: Cost	\$442	\$589	+147*
Heat & Cool cost/MONTH	\$317	\$211	-\$106
Heat & Cool cost/YEAR	\$3806	\$2527	-\$1279
Design load: Heating	251.4 kBtu/hr	162.0 kBtu/hr	-89.4 kBtu/hr (-36%)
Design load: Cooling	113.8 kBtu/hr	72.9 kBtu/hr	-40.9 kBtu/hr (-36%)

<b>MODEL #3</b>		■ Two-story floor plan in Chicago, IL (cold climate) with an envelope surface area of 9556 f <sup>2</sup> . ■ Utility Rates: .11/kW and .70/therm. Thermostat set to 71°F heating and 76°F cooling.	
<b>Categories</b>	<b>Standard Home: (.75ach)</b>	<b>BASF Home</b>	<b>Savings &amp; Benefits</b>
<b>R Values:</b>	<b>R-Values:</b>	<b>R-Values:</b>	<b>R-Value Increase</b>
Ceiling	R-38	R-38	R-0
Walls	R-13	R-13	R-0
Frame Floors	R-30	R-41	R-11
Space Heating: Units	264.3 MBtu	145.9 MBtu	-118.4 MBtu
Space Heating: Cost	\$1846	\$1019	-\$827
Space Cooling: Units	7.1 MBtu	9.2 MBtu	+2.1 MBtu*
Space Cooling: Cost	\$228	\$296	+\$68*
Heat & Cool cost/MONTH	\$173	\$110	-\$63
Heat & Cool cost/YEAR	\$2074	\$1315	-\$759
Design load: Heating	105.1 kBtu/hr	65.2 kBtu/hr	-39.9 kBtu/hr (-31%)
Design load: Cooling	57.0 kBtu/hr	34.4 kBtu/hr	-22.6kBtu/hr (-35%)

\*The very low infiltration of the BASF insulated house makes it necessary to provide mechanical ventilation to meet ASHRAE Standard 62.2 for ventilation in residential buildings. The increased energy usage associated with the ventilation accounts for the positive cooling energy usage results.

# Compare the Residential Engineered Building Envelope System with Traditional Insulation Materials

	Engineered Building Envelope	Glass Fiber	Wool	Blown Cellulose	Open-Cell Foam
R-Value per inch	6.0	3.0	3.5	3.0	3.5
Approved Air Barrier System	Yes at 1-inch thickness	No	No	No	Yes at 5.5-inch thickness
Seamless Construction	Yes	No	No	No	Yes
Rigid	Yes	No	No	No	No
Fully Adhered	Yes	No	No	No	Yes
Adds Structural Strength	Yes	No	No	No	No
Long Service Life	Yes	No	No	No	Yes
Absorbs Water	<4% v/v	Yes	Yes	Yes	>40% v/v
Allows Moisture Vapor In	No	Yes	Yes	Yes	Yes

Honeywell is a global leader in the development and production of high-performance rigid foam blowing agents and the elimination of ozone-depleting refrigerants and chemicals continues to be a key environmental focus. Honeywell Enovate® technology is an award-winning, zero-ozone-depleting blowing agent, developed as a result of extensive R&D into safe, environmentally-friendly alternatives to hydrochlorofluorocarbons.

## The Role of the World's Leading Chemical Company

Sustainability is a core strategy for BASF. The company has been ranked as the number one chemical company in Fortune magazine's 'Global

Most Admired Companies' survey. BASF placed first in all attributes evaluated by more than 10,000 senior managers at 345 companies. These attributes included quality of products and services, innovation and responsibility to the environment.

BASF Polyurethane Foam Enterprises is the only manufacturer to offer a complete engineered building envelope system. As demand for sustainable construction materials and applications continues to grow, BASF Polyurethane Foam Enterprises offers new cost-effective solutions, developed at extensive R&D facilities around the world.

This fact Sheet complies with the Federal Trade Commission labeling and advertising of home insulation rules and regulations, Federal Register, 16 CFR Part 460 Labeling and Advertising of Home Insulation: Trade Regulation Rule; Final Rule, Tuesday, May 31, 2005.

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<sup>1</sup> Green Building SmartMarket Report 2006, McGraw Hill Construction

<sup>2</sup> Building Envelope and Environmental Control: Part 1 – Heat, Air and Moisture Interactions, M.T. Bomberg and W.C. Brown, Construction Canada, 35(1), 1993.

<sup>3</sup> Flood Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas in Accordance with the National Flood Insurance Program, FEMA Technical Bulletin 2-93

<sup>4</sup> American Lung Association, www.epa.gov/mold/cleanupeguidelines.htm

<sup>5</sup> Honeywell 2005 Home Buyer Survey

<sup>6</sup> Green Building SmartMarket Report 2006, McGraw Hill Construction

<sup>7</sup> ASHRAE 2005 Handbook, Chapter 25, Table 4 – Thermal Properties.