THE EVOLUTION OF SPRAY FOAM INSULATION.

YOUR GUIDE TO ICYNENE-H_2FOAM™ INSULATION

H_2Foam

ICYNENE®

THE EVOLUTION OF INSULATION™

MADE IN CANADA SINCE 1986

Since its establishment in Toronto, Canada in 1986, Icynene has developed a range of high-quality spray foam insulation products, ideal for commercial and residential projects. Over the years, Icynene has become the undisputed leader in insulation materials. Discover why...

OUR VISION:

WE ASPIRE TO BE THE WORLD'S PREFERRED INSULATION SUPPLIER - PREFERRED BY CONTRACTORS, BUILDERS, ARCHITECTS, AND HOMEOWNERS FOR OUR INDUSTRY-LEADING, ENERGY-SAVING SOLUTIONS.

Manufactured in Canada in an ISO 9001-2008 certified facility, Icynene spray foam insulation products are designed to meet industry requirements of energy conservation, air tightness, reduced thermal bridging, moisture and mould control, indoor air quality, durability, acoustic performance and affordability.

WHY WE'RE DIFFERENT

Our challenge is to go beyond the building regulations and offer much more to our customers. Available in more than 30 countries, Icynene was the first spray foam manufacturer to help define a European standard for insulation foam. Furthermore, we are the first manufacturer to offer innovative spray foam products that do not contain harmful gases or formaldehyde. Our commitment to quality and innovation is recognised globally.

BBA APPROVAL INSPECTION TESTING CERTIFICATION TECHNICAL APPROVALS FOR CONSTRUCTION

IRISH AGRÉMENT BOARD BUILDING PRODUCT CERTIFICATION

UK GREEN BUILDING COUNCIL Associate Member

ETA

CSTB le futur en construction

CHPS COLLABORATIVE FOR HIGH PERFORMANCE SCHOOLS MEMBER

NAHB RESEARCH CENTER GREEN APPROVED

ENERGY STAR PARTNER

U.S. GREEN BUILDING COUNCIL MEMBER

CE

GreenSpec® LISTED www.GreenSpec.com

Fraunhofer

CANADA GREEN BUILDING COUNCIL · CONSEIL DU BÂTIMENT DURABLE DU CANADA · MEMBER

air barrier abaa association of america

OUR GLOBAL PRESENCE

Icynene spray foam insulation products are available in more than 30 countries worldwide. With contractors and offices in North America, Europe, Asia and Australia, Icynene offers global solutions for local applications.

- Canada
- The United States
- Australia
- New Zealand
- Mexico
- The Bahamas
- The Cayman Islands
- Curaçao
- China
- Estonia
- Austria
- Japan
- Kazakhstan
- Kygryz Republic
- South Korea
- Belgium
- Luxembourg
- Czech Republic
- Slovakia
- France
- The Netherlands
- Ireland
- Latvia
- Lithuania
- Poland
- Russia
- Sweden
- United Kingdom
- Ukraine
- Saudi Arabia
- Portugal

WHY ICYNENE?

Icynene spray foam insulation products are the result of extensive R&D over our 25+ year history. Unlike other global manufacturers that offer a vast range of construction materials, our focus on spray foam insulation ensures we offer top quality products and remain innovative leaders within the insulation sector.

Key Features of Icynene Spray Foam Products

- Icynene is an insulation material and an air and sound barrier as well.
- Icynene spray foam products are safe, odourless, healthy, sustainable and durable.
- Icynene products are 100% water blown.
- Icynene spray foam can help achieve significant savings - up to 50% savings in monthly heating and cooling costs.
- Icynene helps to improve indoor air quality - acting as a very effective barrier against the entry of allergens and pollutants such as pollen or dust.
- Icynene can quickly insulate even the most complex structures expanding up to 100 times its size within seconds filling in every crack and cavity to provide a completely sealed structure. Its air-sealing qualities do not allow air infiltration.
- Icynene spray foam does not settle over time.
- Icynene spray foam is flexible and can follow a building's movements with the seasonal changes, maintaining its air sealing properties.
- Icynene spray foam does not absorb water nor retain moisture, helping to reduce the risk of condensation and mould growth.
- Icynene is not degraded by humidity.
- Icynene is applied by skilled licensed professionals using sophisticated equipment.
- Icynene spray foam products have a 25-year limited warranty.

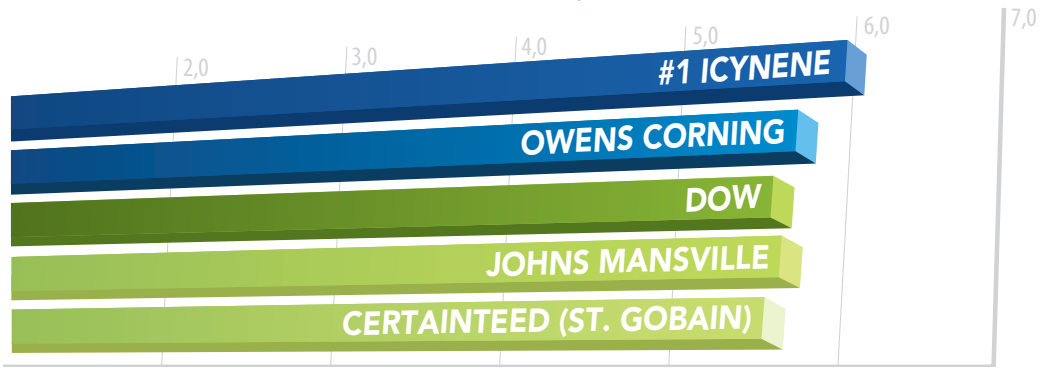
IN NORTH AMERICA, ICYNENE SPRAY FOAM INSULATION IS REGARDED AS NUMBER 1 IN QUALITY AMONGST BUILDERS.

ICYNENE IS RECOGNISED BY TOP BUILDERS ACROSS THE USA AND CANADA AS THE BEST QUALITY INSULATION PRODUCT AVAILABLE ON THE MARKET.

AN INDEPENDANT SURVEY IN 2012 ASKED NEARLY 3000 BUILDERS:

Which insulation has the best quality?

Their Answer: ICYNENE®



Source: Builder Brand Use Study 2013 , Hanley Wood/ReadEx.

UNDERSTANDING ICYNENE AND SPRAY FOAM INSULATION

Is Icynene toxic in case of fire?

Icynene H_2Foam Lite contains 99% air. The 1% that makes up its structure will not help propagate flame in case of fire nor will it emit significant quantities of toxic fumes. The material that can be consumed during a fire is very low: 7-8kg/m^3.

Raw Materials and Chemical Reactions of Spray Foam Insulation

Icynene spray foam insulation is produced by mixing two chemicals that react upon application: a resin and a catalyst (also called MDI). The resin consists of polyols, chemicals considered non-toxic, which react immediately with the catalyst to form the foam.

The chemicals used to make the foam must be handled carefully before application. The sprayer is protected by a Tyvek® suit and full face respirator mask to protect against inhaling any airborne foam particles during expansion.

When the two components are mixed in equal proportion, there is an exothermic reaction and polymerisation. The temperature rises to about 70°C to the surface of the foam and then rapidly drops. During the expansion, vapour diffuses out of the foam and the cells fill with air. The foam dries almost immediately.

Our products use basic ingredients similar to those of polyurethane foams (PU foams). However, Icynene's resins do not contain chemicals to aid expansion (blowing agents), which is not the case of PU foams. This difference is important because some chemicals or gases used in PU foams are hazardous. Similarly, all kinds of plastic exist with very different properties, ranging from trash bags to Teflon used in body implants. Icynene spray foam insulation is a high-quality and environmentally neutral foam that does not contain formaldehyde or volatile organic compound.

If spray foam is considered a chemical product, why is it deemed healthy?

While the components that make up the product contain chemicals, the final product is completely safe and neutral. Consider table salt for example. Also known as sodium chloride, it contains the two elements - sodium and chloride. Separately, these elements are not stable, yet together they are completely neutral and safe for humans. So when you consider Icynene spray foam insulation, the chemical reaction makes the product completely inert and the cells are filled only with air. The safety of Icynene spray foam has been verified and proven through numerous tests and studies by independant third parties, according to ISO 16000-9.

Global Warming Potential (GWP)

The Global Warming Potential (GWP) of Icynene spray foam insulation products is very low, equal to 1. Both the foam and resin contain no gases hazardous to the environment. Since the raw materials used for producing the foam expand 100 times, the carbon footprint to transport Icynene is incredibly low. In fact, transporting the raw materials from Canada to Europe uses very little energy and much less space than traditional insulation types such as fibreglass. Transported to Europe by sea, a typical container ship can carry up to 15,000 containers making it one of the greenest modes of transport. Studies by the European Environment Agency have shown that shipping from Canada is equivalent to using a lorry to travel around 250km (155 miles)!

Waste Disposal

The soft open-cell H_2Foam Lite contains 99% air allowing excess foam or waste to be easily compressed. Furthermore, it is not a toxic waste. In some cases the waste can be mixed with soil to aerate it - such as expanded polystyrene beads - or used in the packaging industry.

OUR SPRAYERS ARE HIGHLY TRAINED, LICENSED PROFESSIONALS

Each Icynene spray foam applicator shares the same values as Icynene - to provide quality service and installation. Each of our applicators must successfully complete extensive training, not only on spraying techniques but also concerning on-site safety, compliance to building codes and a thorough understanding of building science.

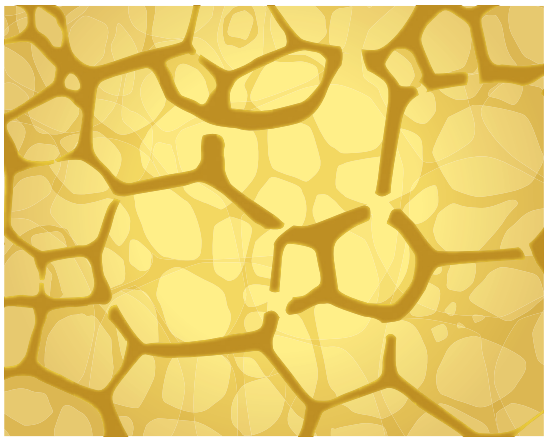
Our spray foam applicators share the same code of conduct - integrity and respect for customers, a strong work ethic and a willingness to create a cleaner and more sustainable environment.

A highly technical, yet economical, insulation product deserves the best equipment available. Our applicators use sophisticated spraying equipment including an air compressor, a dosing system and pressurized components up to 13,800 kPa, a heated hose (with a length that can reach up to 93 metres), spray guns and a current generator.

Using such sophisticated equipment is required to ensure our contractors can spray our insulation products in even the most complicated designs and difficult-to-access structures. Icynene spray foam products should only ever be sprayed by a fully-trained Icynene applicator.

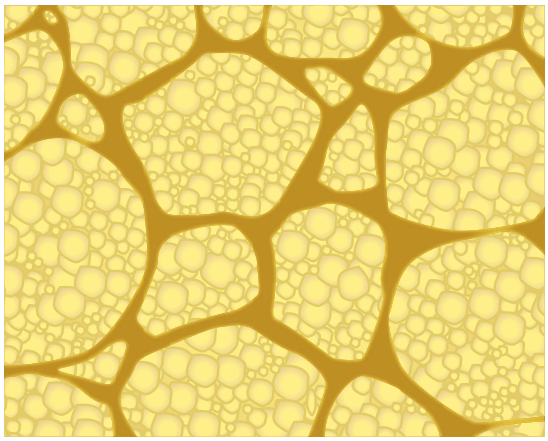
OPEN-CELL SPRAY FOAM & CLOSED-CELL SPRAY FOAM - UNDERSTANDING THE DIFFERENCES

H_2Foam LITE



OPEN CELL

H_2Foam FORTE



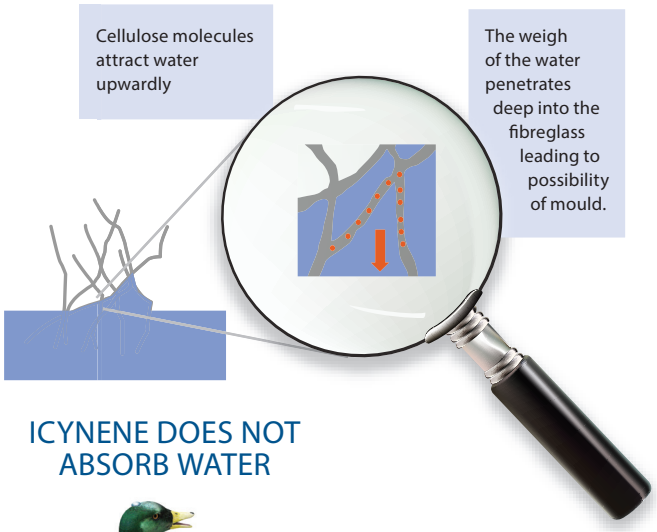
CLOSED CELL

There are two types of spray foam insulation - open-cell and closed-cell. Each has varying characteristics and performance properties ideal in various applications.

Open-cell spray foam is soft and semi-flexible, allowing it to move with the seasonal expansion and contraction of the building. This flexibility ensures that an air-seal is maintained throughout the life of the building. The cell walls of an open-cell foam are irregular and porous, allowing vapour and airborne moisture to pass through it. This facilitates the identification and repair of water leaks in the building envelope itself should it occur. Despite its spongy appearance, Icynene open-cell spray foam does not absorb water.

As a rigid foam, closed-cell spray foam insulation is impermeable to moisture. The walls between the cells are thicker and feature regular interconnections. Depending on the type of foam, the cells are filled with air (such as Icynene H_2FOAM Forte) or gas. The greater density of a closed-cell foam contributes to better thermal performance as well as heightened rigidity, which participates in the stability of the structure.

WATER ABSORPTION BY CELLULOSE AND FIBREGLASS INSULATION.



ICYNENE DOES NOT ABSORB WATER

Open cell spray foam H_2FOAM Lite (LD-C-50)

Permeable to water vapour, H_2Foam Lite does not promote mould growth nor does it absorb or retain water, allowing the water to pass through the foam in case of leakage. This allows a leak in the roof, for example, to be easily identified. The product enables bi-directional drying of wall assemblies. As an open-cell product H_2Foam Lite is able to follow the seasonal movements of the structures. H_2Foam Lite has a Lambda value of 0.038 according to ETA No. 08/0018. As an open-cell soft foam, H_2Foam Lite has excellent sound attenuation. The flexible structure allows cells to absorb midrange frequencies and blocks the entry of external air noise.

H_2Foam Lite is ideal for both interior and exterior applications, with a rainscreen, above ground level. Expanding 100 times its size upon application and not requiring a vapour barrier (in most cases*), Icynene spray foam allows construction schedules to remain on time.

* WUFI ® Studies. Fraunhofer Institute for Building Physics, HTB-05/2012 Report prepared for Icynene.

Closed cell spray foam H_2FOAM Forte (MD-R-210)

The only closed-cell spray foam in its class without a chemical blowing agent! With a low permeability to water vapour, this closed-cell product allows for total moisture control and does not promote mould growth. H_2Foam Forte does not absorb water. The rigidity of the foam contributes to the stability and strengthening of structures. Furthermore, H_2Foam Forte features excellent heat resistance making it suitable for indoor and outdoor applications. The strong thermal performance of H_2Foam Forte allows use in confined spaces where insulation thickness is limited.

OPEN CELL VS. CLOSED CELL SPRAY FOAM

H_2Foam LITE

Open Cell Spray Foam

- Does not let air pass through
- Vapour permeable
- Follows seasonal movement of the structure
- Lambda value similar to fibreglass or cellulose
- 100% water-blown
- Air-filled cells, without gas
- Odourless
- Must be protected from the weather
- Excellent acoustic performance
- Expands up to 100 times its initial size

H_2Foam FORTE

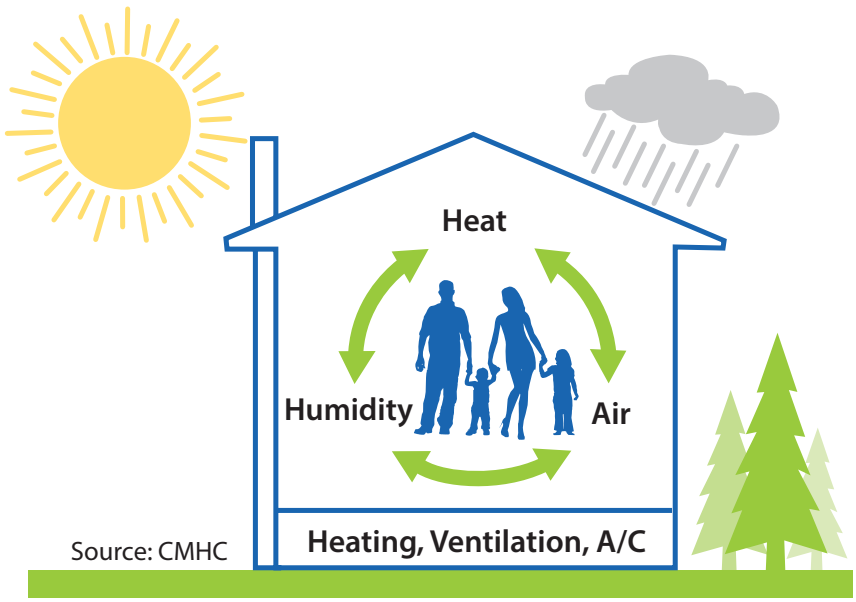
Closed Cell Spray Foam

- Does not let air pass through
- Does not let water and humidity pass through
- Contributes to the building's structural rigidity
- Excellent thermal resistance
- 100% water-blown
- Air-filled cells, without gas
- Odourless
- Suitable for exterior, confined and crawlspace applications
- Does not compress or shrink

BUILDING SCIENCE AND ITS APPLICATION - ICYNENE'S FIELD OF EXPERTISE

Understanding Canadian Building Science and its principles

Every building is an interactive system ...



In their simplest form, buildings are air boxes that provide protection against the outside environment. Yet in reality, they form a complex network of building materials and interconnected systems, all carefully interrelated with one another. If any part of a building is changed, it can affect other areas. Each product used in the construction of a building must be able to work in harmony with the other elements that comprise it.

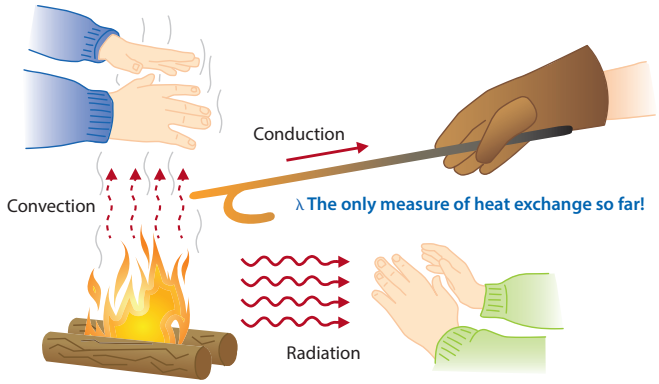
A balanced construction system is like a chain of elements (links) assembled to optimise energy consumption. If one of these elements is defective, then it can be enough to break the balance. For instance, poor air tightness may cancel out the benefits of quality insulation and oversized heating equipment will not necessarily help create a more efficient or "better" building system.

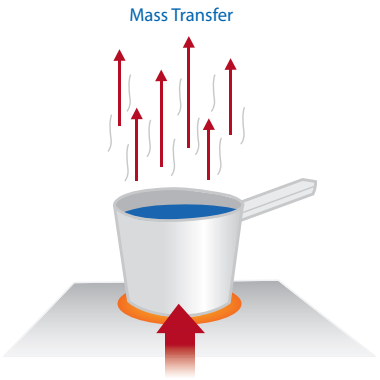
This interdependence is the basis of a "systems approach" used in Canada since the 1970s. The 'systems approach' is a method of design, construction, inspection and testing that takes into account the interactions of the various elements of a building such as foundations, walls, roof, windows, insulation and mechanical systems. It also takes into account the location of the construction site, climate, and behavior of residents. If these interactions are not taken into account, nature will take over and problems arise.

The 'systems approach', together with the use of new building materials, allows architects and builders to create healthy liveable homes that are resistant to problems such as mould growth.

Through this approach, buyers can make a better investment and be able to achieve their long-term goals, architects will see their design creations come to fruition, the risk of hidden defects will be reduced and most importantly, the health of the occupants will be improved.

UNDERSTANDING HEAT FLOW TRANSFER



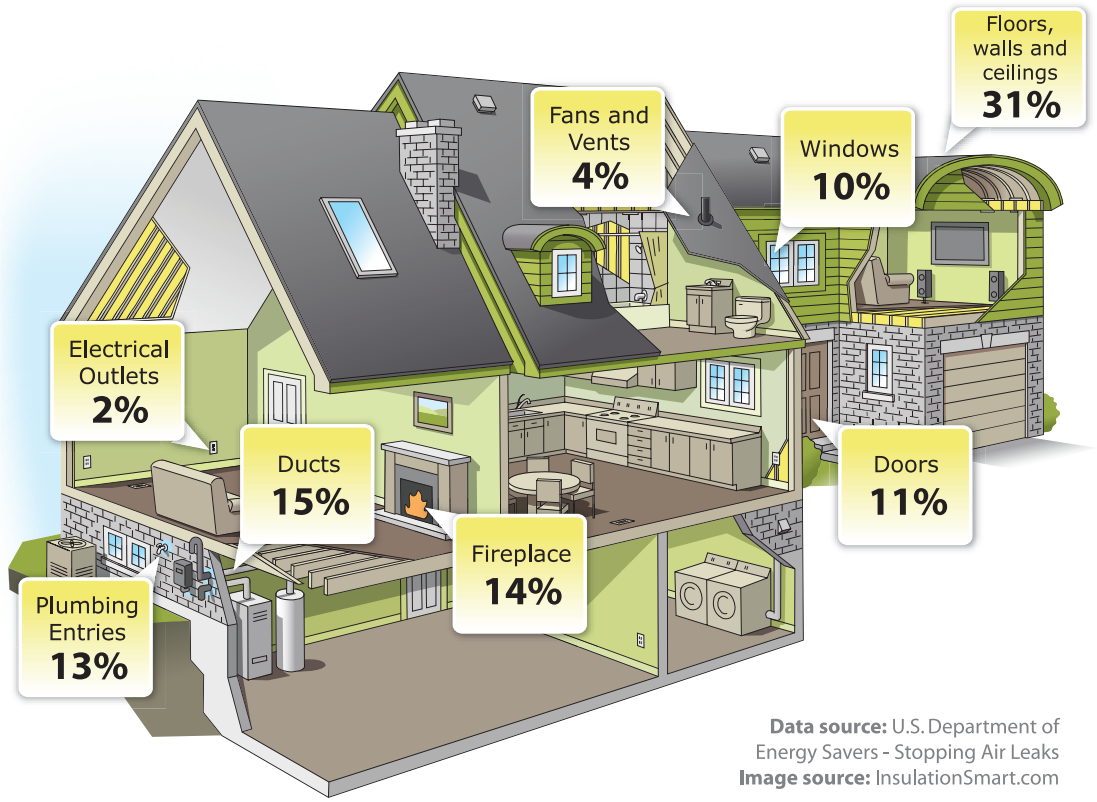


Before talking about insulation, it's best to understand the four types of heat transfer - conduction, convection, radiation and mass transfer.

- The Lambda value is a measure of conduction, that is heat moving through a material. U-Value indicates the amount of heat passing through a wall assembly.
- Convection is the movement of hot air to cold areas. Warm air rises or escapes outside through an opening.
- Radiation from the sun heats the roof and wall materials. The darker the material, the more it attracts heat.
- Mass transfer is characterised by moist air moving naturally to dry areas. The more humid the air, the more it carries cold or warmth through building envelopes.

Until recently, only the Lambda value (λ) or U-value was taken into consideration. Canadian research has changed the industry's understanding of heat exchange flows.

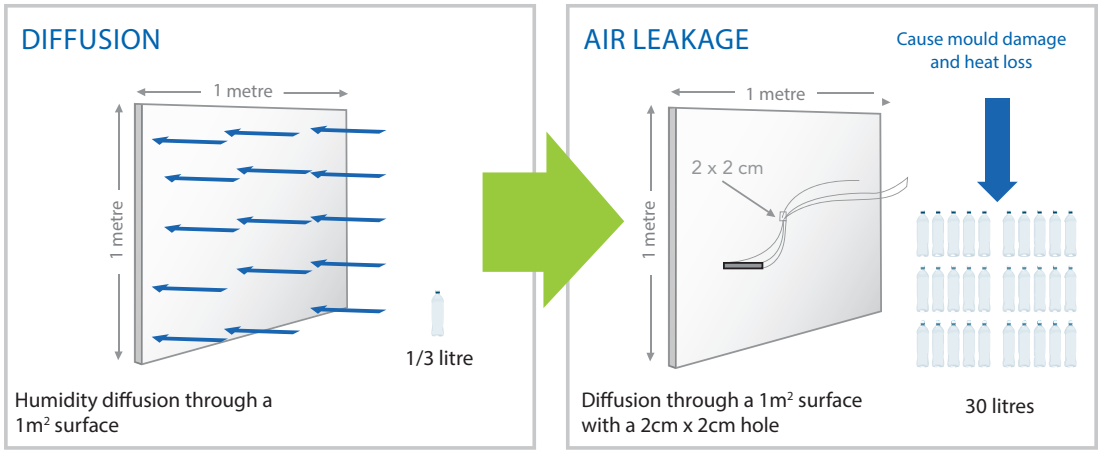
AIR LEAKAGE AND ITS HIGH IMPACT ON ENERGY LOSS



Data source: U.S. Department of Energy Savers - Stopping Air Leaks
Image source: InsulationSmart.com

Independent North American studies have shown that air leakage can account for up to 40% energy loss. Controlling air leakage is essential. Furthermore, moisture build-up through the walls (mass transfer) increases significantly with air leakage while also increasing the risk of mould.

CONTROLLING AIR LEAKAGE = MOISTURE CONTROL

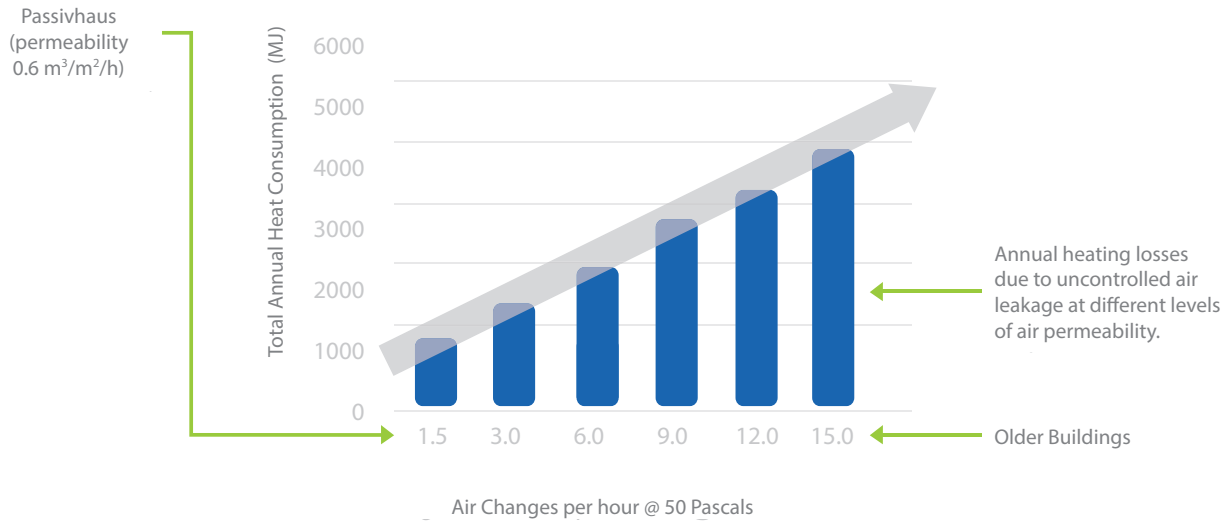


Source: CMHC

In laboratory conditions, the diffusion of moisture through gypsum board was measured by natural diffusion. When a small hole is made in the wall, the amount of moisture that passes through it is multiplied by almost 100! Therefore, it is essential to limit air leaks in buildings. Studies by the Canadian Government have showed that the consumption of energy (and thus, heating) is directly related to the air tightness of a building.

ANNUAL ENERGY CONSUMPTION OF A 120M² HOUSE

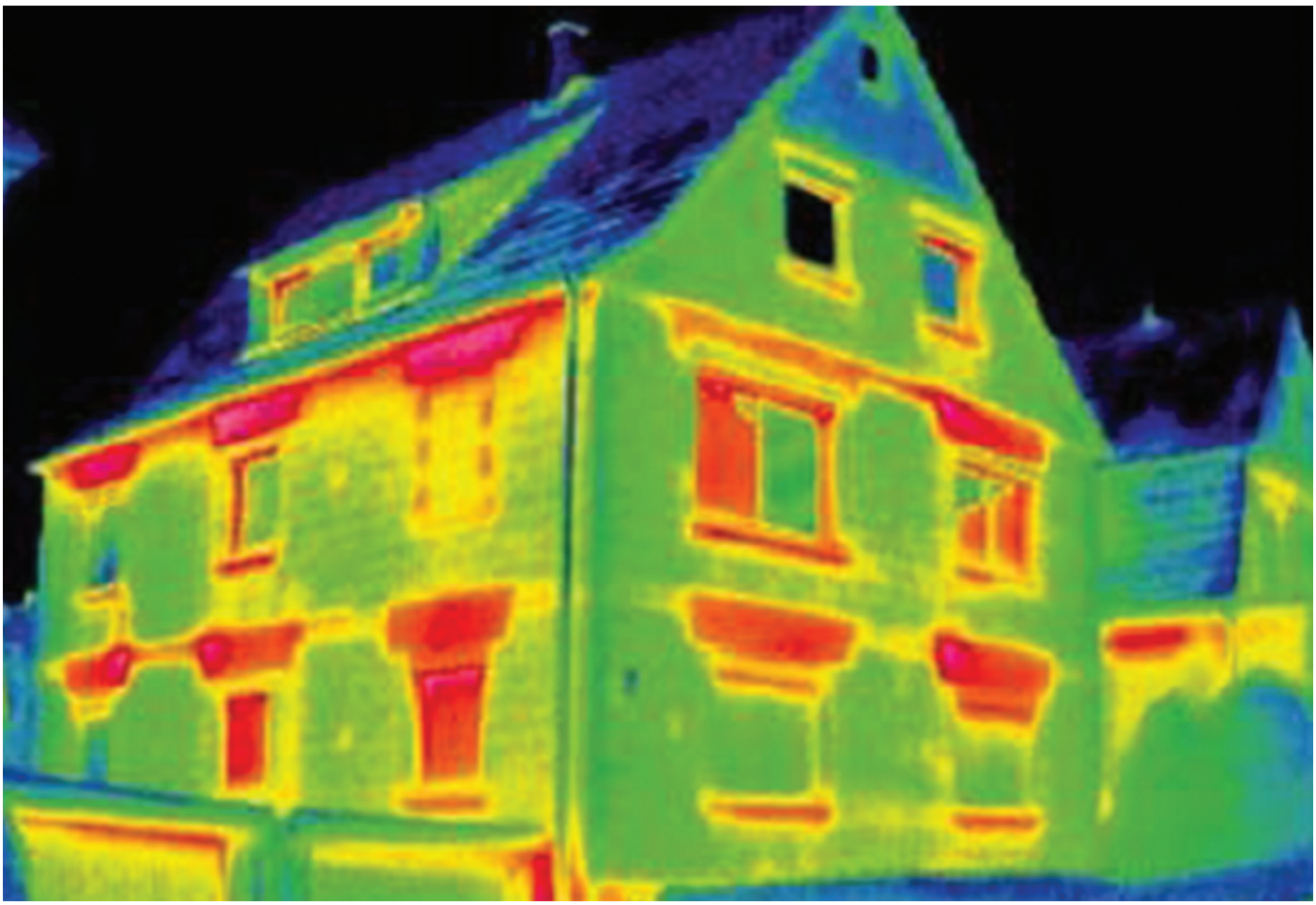
(GLASGOW, SCOTLAND) DEPENDING ON AIR TIGHTNESS - SOURCE: CMHC (THE GOVERNMENT OF CANADA)



KEY POINTS OF BUILDING SCIENCE

- Insulation's Lambda or U-value partially explains energy consumption. Real, measured U-Value is degraded with air infiltration.
- Controlling air tightness is essential, yet no one can live in a completely closed environment. There must be mechanical controls that allow air flow through a home, such as ventilation with heat recovery equipment.
- A good air seal is able to help limit the entry of airborne allergens and pollutants such as dust or pollen.
- To control moisture movement is to limit energy loss, limit condensation (eliminate thermal bridges) resulting in reduced mould growth.
- Walls must allow moisture to escape and remain airtight at the same time.

Icynene has always been at the forefront of building science principles since its inception in 1986.



ICYNENE'S ACOUSTIC PERFORMANCE

According to tests conducted in several countries including the UK and France, the acoustic performance of Icynene's H_2Foam Lite (LD-C-50) greatly exceeds the reference curve, particularly in the midrange beyond 400 Hz with $R_{A,tr}$ values up to 48dB in wooden frame walls and up to 77dB in concrete. The foam's elastic and air-sealing properties help dampen vibrations while blocking airborne noise from outside. The foam's airtightness also helps block the entry of pollens and other external pollution.

WUFI® MODELING CONDUCTED IN GERMANY BY THE FRAUNHOFER INSTITUT FÜR BAUPHYSIK

(Report htb 05/2012)

Fraunhofer

The Fraunhofer Institute conducted WUFI® modeling on Icynene spray foam using weather conditions of Manchester, UK, the results indicate that installation of a vapour barrier (VCL) is not necessary unless required by local certification. Indeed, the permeability of H_2Foam Lite allows walls to breathe and dry bi-directionally. In temperate climates except in rooms with high humidity or in poorly ventilated areas, it is best not to install a vapour barrier since it could trap moisture and cause condensation amongst other problems. Icynene does not absorb or retain moisture and unlike other insulation products, it helps substantially limit mould growth.

SPRAY FOAM VS. TRADITIONAL INSULATION

SPRAY FOAM

FIBREGLASS

SPRAY FOAM BLOCKS AIR INFILTRATION

Icynene spray foam acts as a windbreaker jacket that keeps you warm. It prevents air from passing through.

Fibreglass and cellulose insulation is like a woollen jumper - without wind, it keeps you warm. But despite the thickness, it does not provide good heat resistance when there is wind.

SPRAY FOAM IS A HEALTHY, MODERN MATERIAL

Icynene spray foam insulation is a modern material available in thirty countries. Hundreds of thousands of buildings across the globe are already insulated with Icynene spray foam insulation.

Fibreglass is an old solution and cellulose is little more than shredded newspaper. They both compress over time and absorb moisture.

SPRAY FOAM CAN INSULATE DIFFICULT-TO-ACCESS SPACES

Spray foam insulation expands up to 100 times its original volume to fill all the empty spaces - ensuring maximum thermal insulation and air-sealing.

Fibreglass and cellulose are very difficult to install perfectly. If you add up all the areas that cannot be properly insulated, it can equate to a hole the size of a basketball allowing enough air escape to fill two airships every day!

SPRAY FOAM HELPS PROTECT AGAINST MOISTURE

Spray foam insulation like H_2Foam Lite does not wick water instead letting water and moisture move through to dry out completely.

Cellulose is made of shredded newspaper that absorbs water. Fibreglass and cellulose do not reject water - the water stays in place and can cause damage to your building also reducing the insulating performance. This is one of the factors that contributes to mould growth.

ICYNENE SPRAY FOAM IS HEALTHY

Icynene spray foam does not contain formaldehyde, HCFC, CFC and HFA and produces no toxic emissions. Icynene foam cells are only filled with air unlike conventional polyurethane foams. French authorities on VOC have granted their highest A+ rating to Icynene.

Most fibreglass products contain formaldehyde. Additionally, the production of fibreglass consumes a large amount of energy. The borate salt content in cellulose has been a controversial issue due to its impact on health.

SPRAY FOAM DOES NOT ATTRACT PESTS

The majority of spray foams are not considered food sources for rodents, termites and other unwanted creatures. Additionally, they are not conducive to the creation of rodent nests.

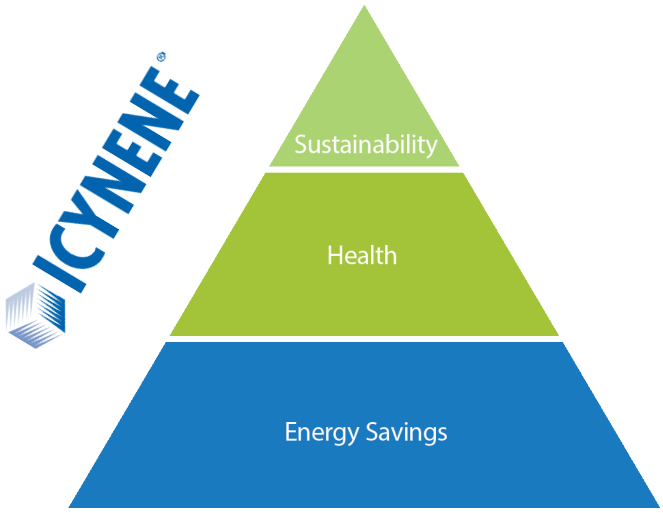
Fibreglass and cellulose can be ravaged by insects and some rodents can even nest there since fibres are air permeable.

SPRAY FOAM DOES NOT EASILY DAMAGE

H_2Foam Forte is a medium-density, closed-cell spray foam that actually adds to a building's structural integrity. H_2FOAM Forte hardens into a dense material that is difficult to damage.

Fibreglass and unprotected cellulose can sag and be damaged by rodents, domestic animals and humidity.

The benefits of Icynene can be quantified immediately and especially in the long term:



If the cost to install Icynene and fibreglass insulation (with an air tightness barrier) is similar, overtime Icynene's insulating and air-sealing properties make all the difference in savings! Let's take a look at the example below - The cost of insulating and making a 120 m² house air tight.

	ICYNENE	FIBREGLASS	Δ€	Δ%
Average price/m² with 15cm of insulation (€)	30	15	-15	-50
Price for air-sealing membrane (€12-€20)	0	12	12	
TOTAL TRUE COST PER M²	**30**	**27**	**-3**	**-10**
TOTAL INSULATION COST FOR 400 M²	**12000**	**10800**	**-1200**	**-10**
Perceived Costs				
10% bonus for a healthy product	-1200	0	+1200	
PERCEIVED BUYING VALUE	**10800**	**10800**	**0**	**0%**
Annual Heating Costs				
HYPOTHETICALLY €2,500 / YEAR WITH FIBREGLASS				
15% reduction with Icynene: airtightness & reduced thermal bridges	2125	2500	+375	
CUMULATIVE COST AFTER 15 YEARS	31875	37500	+5625	
RENOVATION AFTER 15 YEARS				
TO FIX AIR TIGHTNESS & SAGGING WITH FIBREGLASS				
ENERGY -> 1/3 OF THE ORIGINAL COST	0	4000	+4000	
AFTER 15 YEARS -> INSULATION COSTS + ENERGY + RENOVATION	**42675**	**52300**	**+5625**	**23%**

ADVANTAGE ICYNENE!

- ✓ Icynene's air-sealing qualities will help reduce energy consumption by at least 15%
- ✓ Icynene does not degrade over time, air tightness and insulation properties are preserved
- ✓ It is likely that air-sealing tests will be imposed in the future when a building is sold or rented
- ✓ It is likely that after 15 years, fibreglass becomes compacted and its insulating properties are degraded meaning renovations are needed to improve the energy consumption performance

APPLICATION EXAMPLES

CERTIFICATIONS & ACCREDITATIONS

CE, European Technical Approval No. 08/0018

BBA Agrément No. 08/4598

Irish Agrément Board No. 09/0333

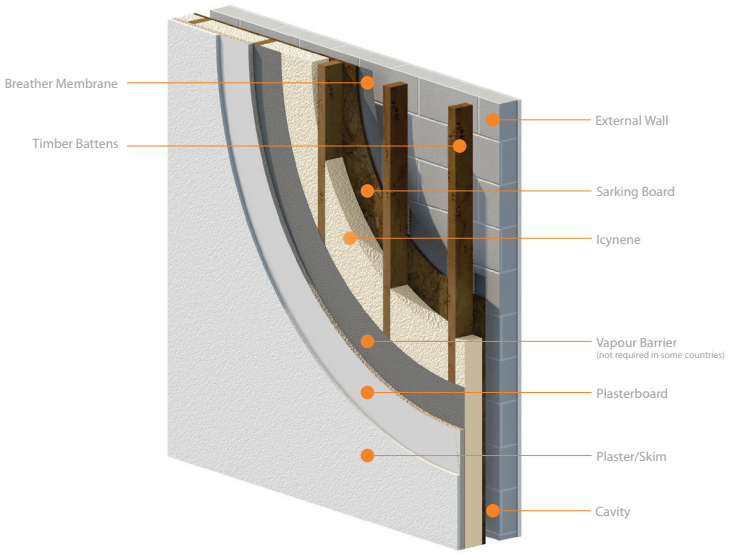
VOC Test According to ISO 16000-9, CERTECH No. 10/229

Made in Canada in an ISO 9001-2008 accredited facility.

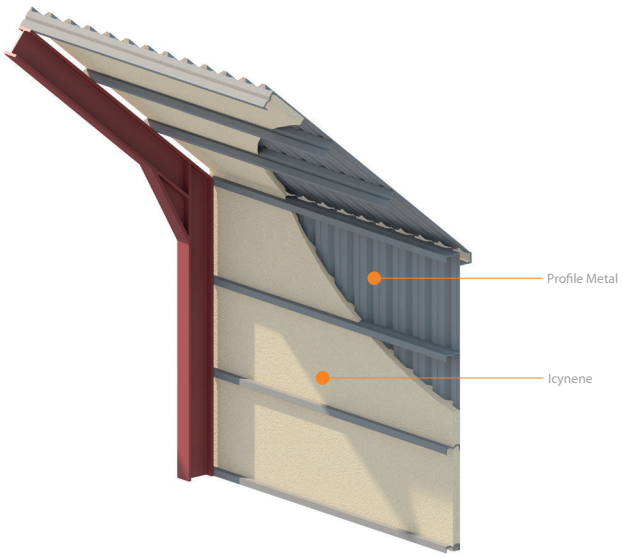
More than 400,000 buildings insulated with Icynene worldwide since 1986.

Ideal for hard to insulate areas

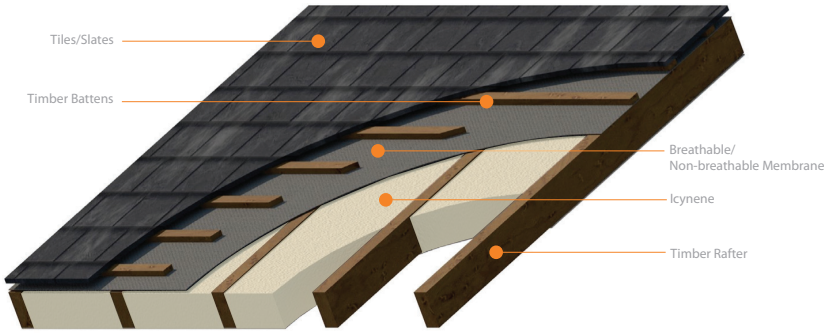
Icynene spray foam can reach and insulate the most complex designs



Timber Frame Wall*



Commercial Application*



Roof Insulation*

*images courtesy of Thermloc Insulations

Reduction of thermal bridges

ICYNENE®

- Does not sag with gravity
- Perfect air sealing properties
- Odourless
- Not considered a food source for mould or pests
- Does not propagate flames
- Does not absorb water
- Open-cell and Closed-cell products without gases that are hazardous to health
- Carried on-site in a highly concentrated formula 1/100th of its final volume - lower carbon footprint

Find up-to-date information and specifications regarding our portfolio of spray foam products by visiting our websites and our Icynene Europe Facebook® page.

www.icynene.co.uk

www.icynene.eu

www.icynene.fr

www.icynene.com

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