Spray Foam
The Answer to Our Energy Challenge

Mac Sheldon
Demilec USA, LLC
www.DemilecUSA.com
US Energy Consumption

- Industry: 33%
- Buildings: 39%
- Transportation: 28%

21% Residential
- Refrigeration: 9%
- Cooling: 10%
- Lights: 12%
- Water Heat: 13%
- Heating: 32%
- Other: 4%

18% Commercial
- Cooking: 2%
- Computers: 3%
- Refrigeration: 4%
- Office Equipment: 7%
- Ventilation: 7%
- Water Heat: 7%
- Cooling: 13%
- Heating: 16%
- Lights: 28%
- Other: 10%

42%
Green Building Drivers

“Work on demand side before supply side”

Dr. Mark Bomberg, Building Energy and Environmental System laboratory
Syracuse University

Building Performance

Manufacturing Efficiency

Material Sourcing and Transportation

LCA – Life Cycle Analysis
Home Performance

HERS® Index

More Energy

150
140
130
120
110

Existing Homes

Standard New Home

100

This Home

65

Zero Energy Home

Less Energy
Spray Foam LCA

• Increased building efficiency
  – High R-value + Low Air Leakage = Reduced Energy Consumption (±40% lower)

• Reduced Transportation
  – ccSPF 1 truck load = 1,040,000 R’s 3-4 T/L FG
  – ocSPF 1 truck load = 2,280,000 R’s 7-8 T/L FG

• Less Embodied Energy
  – Recycled and Renewable Materials
Entire Life Cycle included

Ingredients:
- Plastics
- Water
- Packaging materials etc.

Boundary of Insulation Production

Emissions to air, water and soil (waste)

Embodied energy & GWP estimated using ISO 14040

Use phase estimated using DOE EnergyPlus

Energy, fuels, other inputs

Use phase estimated using DOE EnergyPlus

Use
End-of-Life

Extraction of raw materials → Manufacturing of raw materials → Insulation manufacturing → Insulation installation → Use
Lifetime Source Energy Savings

ASHRAE 90.1-2010P VS ASHRAE 90.1-2004

**Roofs**
- Energy Saved: 633 Trillion Btu
- Embodied Energy: 22 Trillion Btu
- Saved vs. Embodied: 29:1

**Walls**
- Energy Saved: 629 Trillion Btu
- Embodied Energy: 11 Trillion Btu
- Saved vs. Embodied: 57:1
Annual Source Energy Savings
ASHRAE 90.1-2010P VS ASHRAE 90.1-2004

*Source: NYT and Fox News 8/5/09 reports

**CBECS 2003
Low & Medium Density Spray Foam Insulation

Low Density
- Open Cell
- ½ - Pound
- Water Blown
- Semi Rigid

Medium Density
- Closed Cell
- 2 - Pound
- Rigid Foam
What is Low Density Spray Foam Insulation?

• Low Density uses water as the blowing agent
• Environmentally friendly and recognized as a “Green Product”
  • zero ODP
  • Does not contain CFCs, HCFCs, fibers, formaldehyde, or asbestos
History of Low Density Spray Foam Insulation

- Narrow lots = bonus rooms over garages
  - Problem was cold floors in bonus rooms
  - > 80% of claims were coming from cold floors
  - Open cell spray foam technology = solution
  - Now specified in new construction

This is where it all started!
Improper Installation of Fiberglass

Insulation has fallen out, voids can be seen

The existence of this void is what started the ½ lb spray foam industry!!!
Fiberglass Insulation Is Not Always Installed According to Your Specification

- Stapled and Compressed insulation loses R-value
- Two pieces hang side by side to fill cavity
- Gap between insulation and floor
Why the R-values of loose fill insulations do not work.

How do you insulate these situations?

Gap to outside Daylight
Fiberglass Insulation Is Not Always Installed According To The Instructions
The Same Job Using IR Imaging
Insulation & Air Seal

- Insulates and air seals in one application
- No voids or gaps between insulation and studs
- Excellent adhesion
  Perfect fit every time
- Doesn’t sag, settle or deteriorate
- Outperforms loose fill insulation
Semi-Rigid Spray Foam Insulation

• More than 40% of energy loss from a residence is due to air infiltration – DOE

• Controlling movement of warm moist air (preventing condensation) is very effective in stopping the proliferation of molds
Mold spores are always in the air.

Molds require three conditions for mold spores to proliferate:
- Food
- Oxygen
- Liquid Water

Effective way to prevent mold growth is to remove one of the three conditions.
Mold & Mildew - No Air Barrier
Diffusion vs. Infiltration

• In cold climates 1/3 quart (310ml) of water can be collected by diffusion through gypsum board without a vapor retarder

• 30 quarts (28 liters) of water can be collected through infiltration
Quiet Buildings

- Sound Transmission
  - Open Cells Absorb Noise
  - STC: 35-50
Quiet Buildings

Result: STC-49*
(Tested in accordance with ASTM E90-02)

Result: STC-50*
(Tested in accordance with ASTM E90-02)
Applications

- Rim joists
- Attics
- Crawl Spaces
- Walls
Spray Foam Works!

• Certainly the greatest benefit of insulating the roof deck is improved thermal performance.
Ductwork in conventional attics is subject to the most extreme temperatures yet they have the least insulation.
Installing the ductwork in a closed attic assembly reduces the duct losses dramatically.
Insulation and Air Seal

- R Value 3.6 – 4.5 per inch
- No thermal performance drift over time
- 100% self adhesive = 100% R-value in the field
  - No settling or compacting
  - No degradation of thermal performance with time
- Follows all shapes or volumes
Proper Sizing of the HVAC System

• By properly sizing HVAC equipment rather than using rules of thumb, smaller systems can often be specified and, hence, initial cost is reduced.

• Proper HVAC sizing can reduce short-cycling of equipment, resulting in longer equipment life and better control over indoor environmental conditions.
Limitations of Use

*Low Density Spray Foam* should **not** be used:

- On wet substrate (frost, oils, etc.)
- Around recessed lights (even if IC cans are used)
  - Leave at least 3” of free air space
  - Overheating is a fire hazard
- Inside electrical boxes
- In contact with water
Limitations of Use

Low Density Spray Foam should **not** be used as:

- As structural material
- As flotation foam
- As a vapor barrier
- Covering flex ducts
MEDIUM DENSITY FOAM

Interior or Exterior of Building
1. Thermal Control Layer (Thermal Insulation)
2. Air Control Layer (Air Barrier)
3. Water Control Layer (Drainage Plane)
4. Vapor Control Layer (Vapor Retarder)
Insulating Buildings from the Exterior

- **Medium Density Spray Foam**
  - Rigid Foam

- **Four-In-One Barrier**
  1. Weather Resistant Barrier
  2. Insulation
  3. Air Barrier
  4. Vapor Retarder

- **Applications**
  - Commercial
  - Residential
  - Industrial
  - Institutional
Bethke Elementary School – First US LEED For Schools Building

Leadership in Energy and Environmental Design
1,000,000 Square Foot Airplane Factory

• Medium Density (Closed Cell Foam) – Class-I ASTM-E84
• Cells filled with 245fa – Zero Ozone Depletion Potential (ODP)
Why Insulate Outside?

- Excellent Hygrothermal Capacitance
  - Heat and Moisture absorption and redistribution

- No Thermal Bridging

- Perfect Air Seal
U.S. Department of Energy

Product Line

• 32-35 kg/m³ Medium Density, Closed Cell Foam

• Enriched with Soy Bean Oil and Recycled Plastics

• Long History of Consistent Performance

• No Product Recall in History of Demilec USA
U.S. Department of Energy

Multi-Family Residential

SOLAR DECATHLON 2009

Energy Efficient, Comfortable & Healthy
Commercial Office Space
Exterior Insulation

- Continuous insulating envelope system
- 100% self adhesive = 100% R-Value in the field
Air Barrier

Individual Products shall have an air leakage $<0.02 \text{ L/sm}^2$
Retail Space

- Air barrier
  - Continuous, Durable, Rigid
  - Spray foam is a complete system
Retrofit Office Space

• Monolithic water, air, rain and vapor control system
Moldy School

- No Air Barrier
  - Infiltration Leads to Mold and Mildew growth
Conventional Air Barrier Membrane

- Brick Ties Through Air Barrier
Spray Applications

- Cold Weather Applications
- Full Coverage Applications
- Commercial Applications
  - Schools
  - Hospitals
- Metal Application
- Block Application
- Foundation
- Renovation Projects
- Single Family dwellings
- Multi-family dwellings
SOLAR DECATHLON
Full-coverage application
Large Commercial Applications

Shopping Center

Airplane Factory
Schools
Metal buildings sprayed on the exterior then covered by metal siding
Concrete Block Application
Can this product be used below ground?

Foundation Application
Renovation Projects
Single Family Dwelling

- Works very effectively on Single family dwellings
  - Eliminates thermal Bridging
  - Windows are installed before the insulation
Multi-family Dwellings
Frequently Asked Questions

• How do you control overspray?
• Is this a seasonal process?
  – Rigid Foam can be processed from 0°F to 104°F.
Frequently Asked Questions

• Will the foam crack or delaminate if the building moves?
  – Significant building failure will occur long before the foam will crack or “fall off”
Frequently Asked Questions

• Is Access a problem?
  – Man Lift
  – Elevator Staging
Frequently Asked Questions

Does it take longer to install?

• Typically the answer is no. The masons often use the same staging
• Weather may impact the project schedule if there is rain, as with any trade working on the outside.
Process

- Field-processed and field-applied
- Quality assurance can be performed at any time during the installation
True Performance of Spray Foam Insulation
SOLAR DECATHLON 2009

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Our Energy Challenge

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