

# Foam Plastic Insulating Sheathing

Delivering Energy Efficiency,  
Carbon Savings & More



[Applied Building Technology Group \(ABTG\)](#) is committed to using sound science and generally accepted engineering practice to develop research supporting the reliable design and installation of foam sheathing. ABTG's educational program work with respect to foam sheathing is supported by the [Foam Sheathing Committee \(FSC\)](#) of the [American Chemistry Council](#).

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Foam sheathing research reports, code compliance documents, educational programs and best practices can be found at [www.continuousinsulation.org](http://www.continuousinsulation.org).



**Foam Plastic Applications  
for Better Building**

# Outline

## Learning Objectives

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## Course Description

## Course Topics

- What is FPIS ci?
- Energy Efficiency Role of FPIS ci
- Total Carbon Savings of FPIS ci
- Multi-functional Applications of FPIS ci for Optimized Assemblies
- Actionable Resources for Design, Construction, & Code Compliance
- Q & A

# Learning Objectives

- Learn how to use FPIS ci for energy efficiency and energy code compliance.
- Learn how the carbon footprint and handprint of FPIS ci yield total carbon emission savings for a building project.
- Learn practical, multi-functional applications of FPIS ci to optimize building assemblies.
- Learn about actionable design and construction resources to support use of FPIS ci for code compliance and enhanced design objectives.

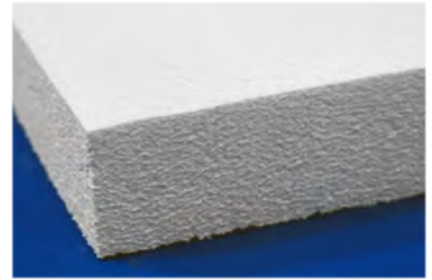
# Course Description

Continuous insulation, particularly foam sheathing, became a popular energy efficiency solution after the 1970's oil crisis. That practical application is still of key importance today and has grown in recognition and need in today's energy market and energy codes. **But, how does foam sheathing address the sustainability and embodied carbon concerns of today? What about resiliency?** Foam sheathing products have made many advancements since the 1970's and are now well-positioned to address sustainability, resiliency, and carbon-saving objectives in addition to several functional requirements for robust code compliance. This course begins at a high level and drills down into the details to help optimize wall assemblies using foam sheathing as continuous insulation. Several actionable resources will be provided.

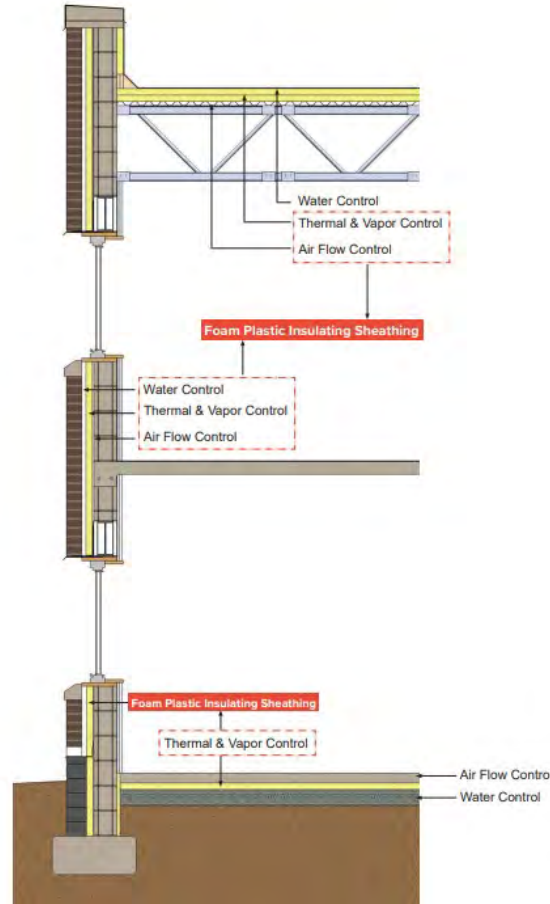
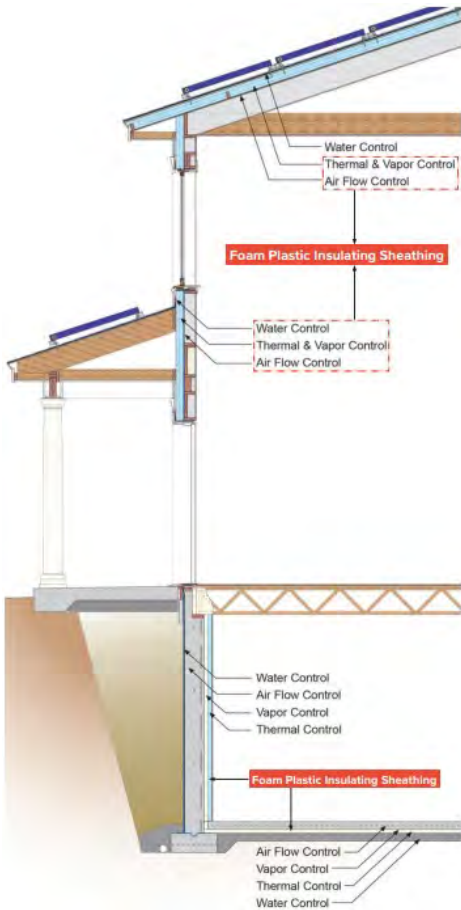
# What is Foam Sheathing?

## Foam Plastic Insulating Sheathing (FPIS)

- “Rigid board,” “foam panel,” “foam sheathing,” etc.
- 10 – 100 psi compressive resistance; ~R4-R7 per inch
- ASTM C578 – Standard specification for rigid, cellular polystyrene thermal insulation (XPS – extruded polystyrene; EPS – expanded polystyrene)
- ASTM C1289 – Standard specification for faced rigid cellular polyisocyanurate thermal insulation board (Polyiso or PIR)
- ASTM C1126 – Standard specification for faced or unfaced rigid cellular phenolic thermal insulation



# What are its building applications?



## Building Thermal Envelope (BTE):

- Foundation insulation
- Exterior wall insulation
- Roof insulation
- Floor/slab insulation

## Building Science Functions:

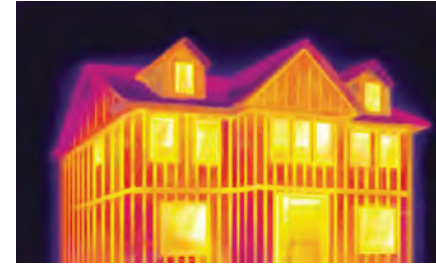
- Thermal Control
- Rainwater Control
- Vapor Control
- Air Leakage Control

# Energy Efficiency Role of FPIS ci

- Continuous insulation (ci)
- Mitigates structural thermal bridging

**CONTINUOUS INSULATION (ci):** Insulation that is uncompressed and continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior or exterior or is integral to any opaque surface of the building envelope.

*(as defined in IECC, ASHRAE 90.1, IBC, and IRC)*



## Before

R-13 batts in cavity between studs



## After

R13 + ½"

rigid foam continuous insulation over studs

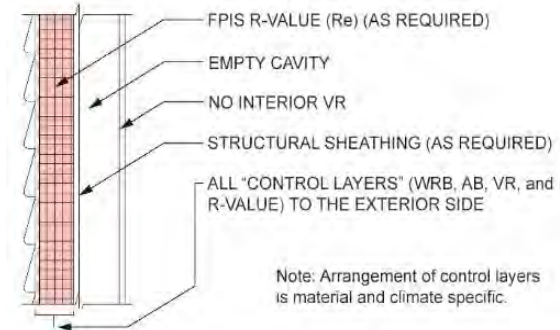
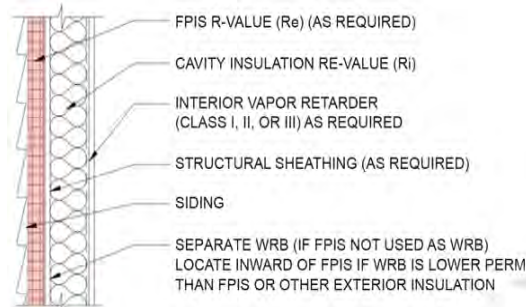
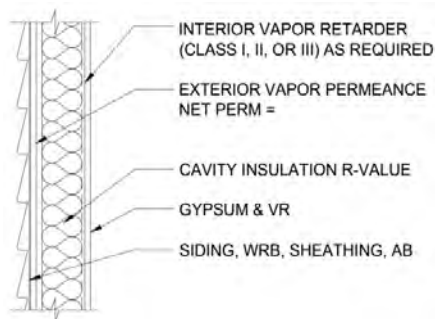
Source: Dryvit/Dow

***" Don't eat your sweater. Wear it! "***

# Typical Methods for Insulating Exterior Walls

- **Cavity insulation only** (traditional method)
- **Cavity insulation + continuous insulation** (common choice for modern code-compliant or high-performance walls)
- **Continuous insulation (ci) only** (the “perfect wall” with all control layers to the exterior – maximum protection and thermal performance)

← CAVITY INSULATION ONLY → CAVITY + CONTINUOUS HYBRID → CONTINUOUS ONLY →



Note: Arrangement of control layers is material and climate specific.

Source: [www.continuousinsulation.org](http://www.continuousinsulation.org)

# Ci Impact on Thermal Performance

## EXAMPLE 1 (wood framing):

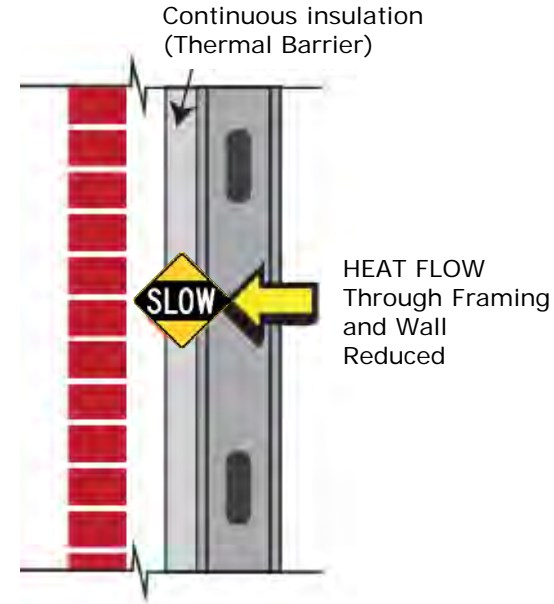
- **R25  $\neq$  R20 + 5ci**
- The **R20+5ci wall is 17% more efficient** than the R-25 wall with cavity insulation only (U-0.045 vs. U-0.054)

## EXAMPLE 2 (steel framing):

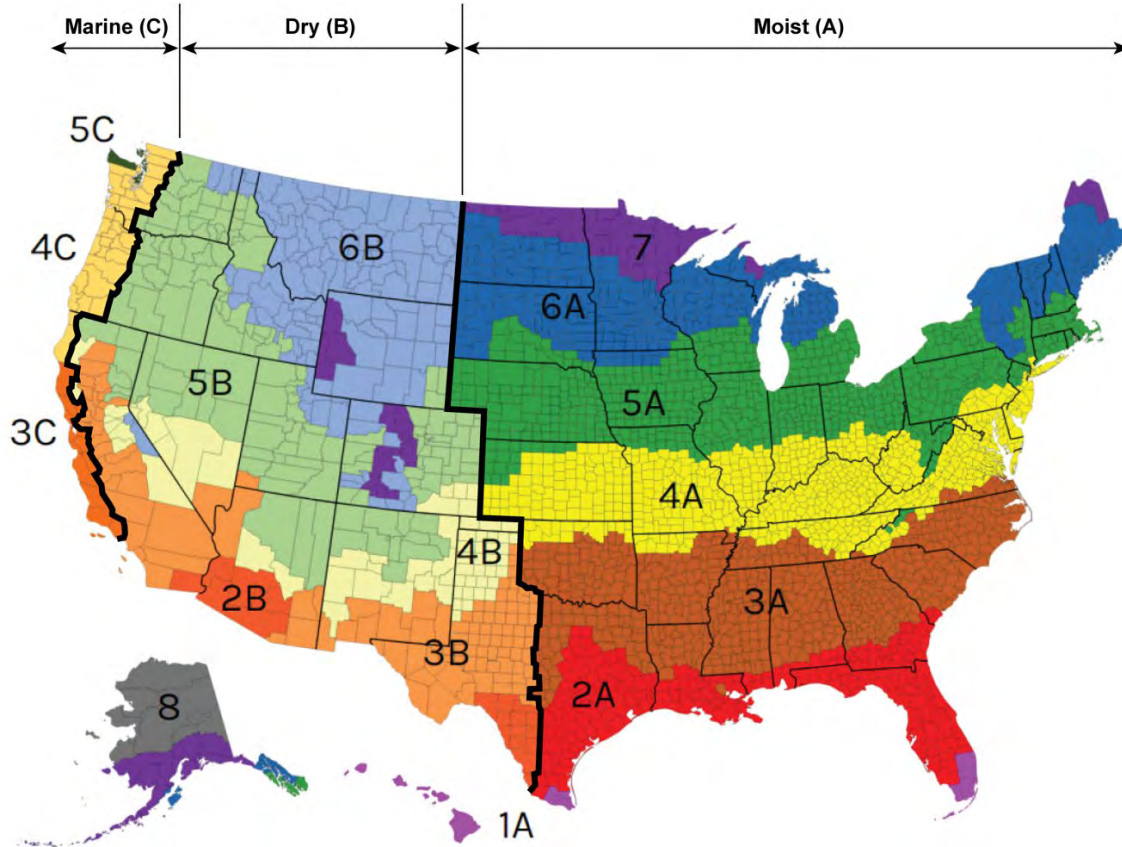
- **R21  $\neq$  R13 + 7.5ci**
- The **R13+7.5ci wall is 40% more efficient** than the R21 wall with cavity insulation only (U-0.064 vs. U-0.106)

**KEY:** Increasing the ratio of ci to cavity insulation R-value increases thermal performance (lower U-factor) and moisture protection of the assembly.

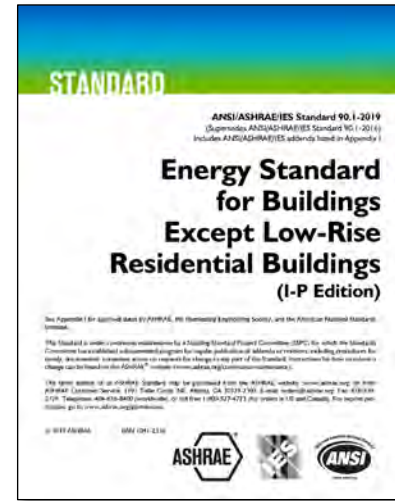
- Provides for robust hygro-thermal performance (moisture & heat control)
- More to come on multi-functional applications



# Energy Code Compliance



Climate Zone Map (US DOE)



# IECC-C Prescriptive Insulation Requirements (Walls)

## 2024 IECC-C – Tables C402.1.2 & C402.1.3 (prior – Tables C402.1.3 & C402.1.4)

Climate Zone	Building Use	Mass	Metal Framed			Wood Framed			
		2018/2021/2024 IECC	2018 IECC	2021 IECC	2024 IECC	2018 IECC	2021 IECC	2024 IECC	
0 and 1	All other	R-5.7ci (U-0.151)	<b>R13+5ci</b> (U-0.077)	<b>R13+5ci</b> (U-0.077)	R0+10ci or <b>R13+5ci</b> or R20+3.8ci (U-0.077)	R13+3.8ci or R20 (U-0.064)	R13+3.8ci or R20 (U-0.064)	R0+12ci or R13+3.8ci or R20 (U-0.064)	
	Group R								
2	All other	R-7.6ci (U-0.123)	<b>R13+7.5ci</b> (U-0.064)	<b>R13+7.5ci</b> (U-0.064)	R0+12.6ci or <b>R13+7.5ci</b> or R20+6.3ci (U-0.064)				
	Group R								
3	All other	R-9.5ci (U-0.104)			<b>R13+10ci</b> (U-0.055)				R0+15.2ci or <b>R13+10ci</b> or R20+9ci (U-0.055)
	Group R								
4 Except Marine	All other	R-11.4ci (U-0.090)			<b>R13+12.5ci</b> (U-0.049)				R0+17.3ci or <b>R13+12.5ci</b> or R20+11ci (U-0.049)
	Group R								
5 and Marine 4	All other	R-13.3ci (U-0.080)			<b>R13+15.6ci</b> (U-0.052)	R0+21ci or <b>R13+15.6ci</b> or R20+14.3ci (U-0.042)			
	Group R								
6	All other	R-15.2ci (U-0.071)	<b>R13+18.8ci</b> (U-0.037)	R0+24ci or <b>R13+18.8ci</b> or R20+17.5ci (U-0.037)					
	Group R								
7	All other		R-25ci (U-0.037)	R13+7.5ci (U-0.064)	R13+15.6ci or R20+10ci (U-0.036)				
	Group R								
8	All other		R-25ci (U-0.037)	R13+17.5ci (U-0.045)	R13+18.8ci (U-0.032)				
	Group R								

**NOTE:**  
All R-value options are equivalent solutions for energy code compliance, but not all are equivalent for building code moisture control compliance

# IECC-R / IRC Ch.11 Prescriptive Insulation Requirements (Walls)

## IECC-R Residential Provisions - Tables R402.1.2 & R402.1.3

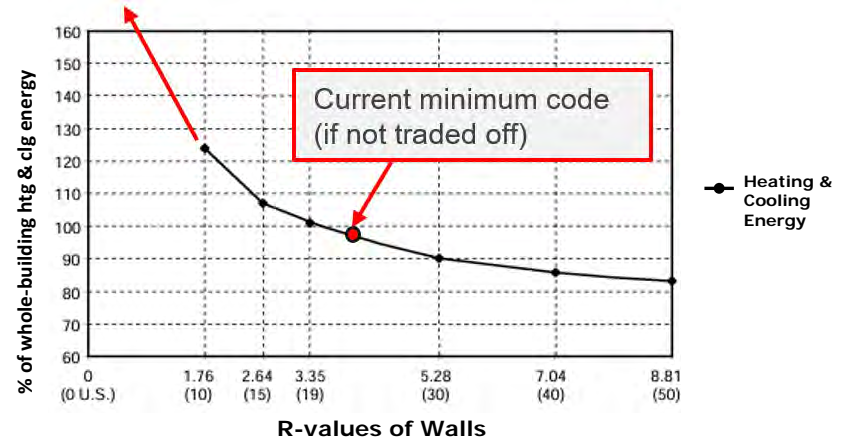
Climate Zone	Wood Frame Walls	
	2018 IECC	2021/2024 IECC
0, 1 and 2	R13 (U-0.084)	R13 or R0+10ci (U-0.084)
3	R20 or R13+5ci ( U-0.060)	R20 or R13+5ci or R0+15ci (U-0.060)
4 except Marine		R30 or R20+5ci or R13+10ci or R20ci (U-0.045)
5 and Marine 4		
6	R20+5ci or R13+10ci (U-0.045)	
7 and 8		

**NOTE:**


All R-value options are equivalent solutions for energy code compliance, but not all are equivalent for building code moisture control compliance

# What is the energy efficiency benefit?

- Substantial energy savings and payback in heating climates for walls with up to R40 (effective R-value = U-0.025) – well above current code minimums.
- However, ... *"any additional wall insulation beyond R-40 wouldn't provide significant economic benefits."*
  - Diminishing returns do limit cost-benefits of more efficiency (first cost vs. future energy cost savings).
  - But this depends how many benefits of insulation are considered and monetized.



**Energy Consumption Rate vs. R-values of Walls (Detroit, Michigan)**

 **Building Simulation 2009** Eleventh International IBPSA Conference  
Glasgow, Scotland  
July 27-30, 2009

**IMPACT OF INSULATION ON BUILDING ENERGY CONSUMPTION**

Jong-Jin Kim and Jin Woo Moon  
TCAUP, University of Michigan, Ann Arbor, USA

# Other Co-Benefits of BTE Energy Efficiency

- Smaller HVAC Equipment Sizes (helps offset first cost)
- Reduces peak energy demand (helps control future energy prices and reliability of supply)
- Improved comfort and productivity

## **Next, we'll consider:**

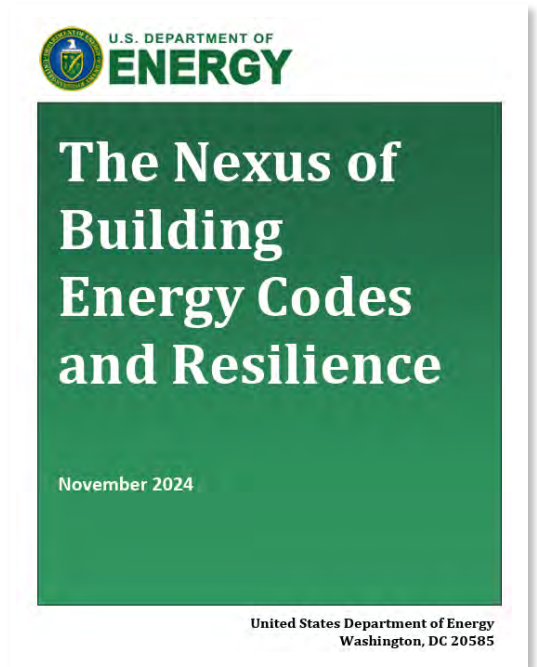
- Improved energy resiliency
- Reduced emissions/pollutants

# What about resiliency?

- Energy codes and the BTE play a key role in energy resilience.
- But what is “energy resilience” and how is it measured?



[https://www.energycodes.gov/sites/default/files/2023-07/Efficiency\\_for\\_Building\\_Resilience\\_PNNL-32727\\_Rev1.pdf](https://www.energycodes.gov/sites/default/files/2023-07/Efficiency_for_Building_Resilience_PNNL-32727_Rev1.pdf)



<https://www.energycodes.gov/sites/default/files/2024-12/The%20Nexus%20of%20Building%20Energy%20Codes%20and%20Resilience.pdf>

# Two functions of energy resilience

**Table 1: Primary Purpose of Building Energy Resilience**

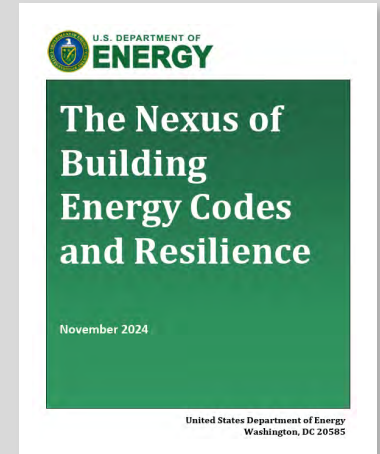
## Passive Survivability

The ability to maintain safe indoor conditions in the event of extended energy outage or loss of energy supply. In practice, passive survivability enables safe indoor thermal conditions, relying on building design measures that require no energy. As a measure of a building's thermal performance, passive survivability offers an integrated assessment of both energy efficiency and resilience.

## Grid Resilience

Building energy technologies that provide efficiency and grid flexibility services. These technologies can provide grid services during peak demand periods. Demand load reductions alleviate energy supply and grid constraints, thereby decreasing the risk of power system failures.

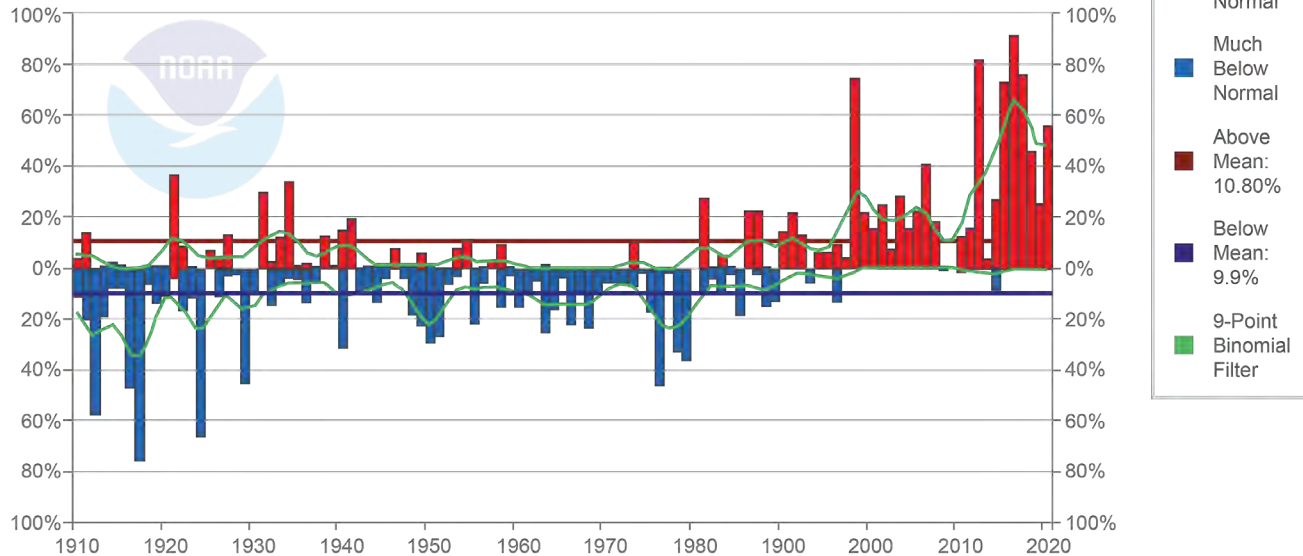
*Energy resilience* may also encapsulate secondary benefits, including improved comfort, safety, and health. Together, these benefits contribute to the broader resilience of a community.



# Measured Change in Climate Hazard

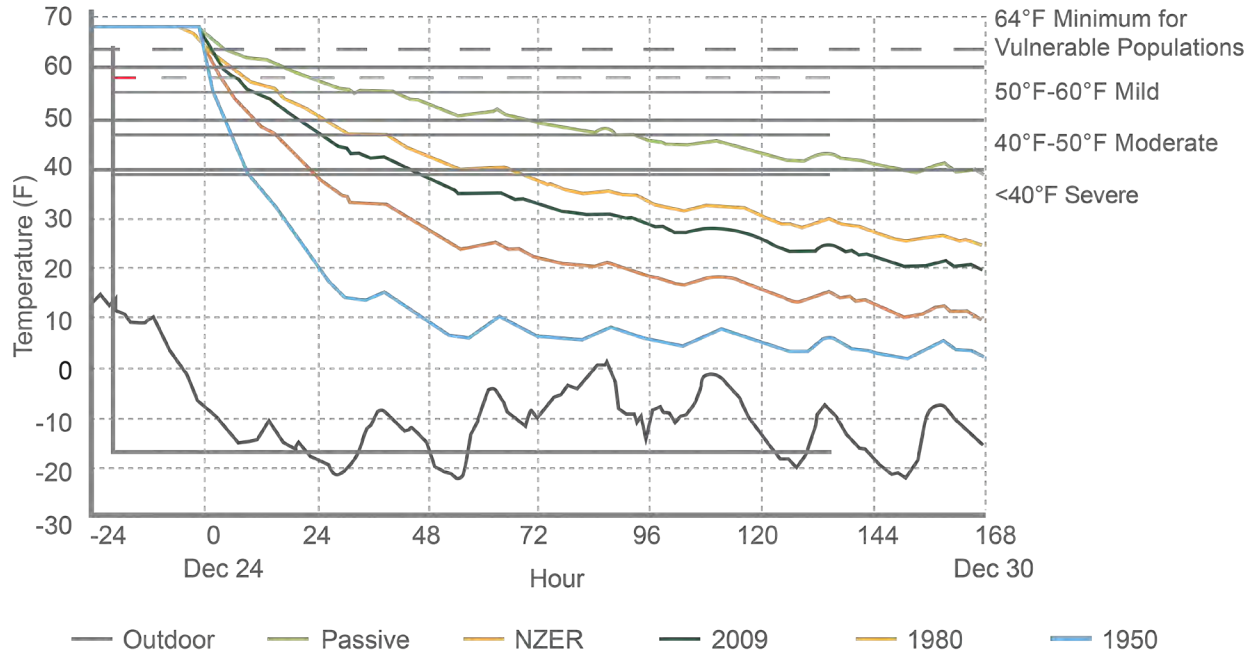
## Contiguous U.S. Extremes in Minimum Temperature (Step 2)

Annual (January-December)



Annual rise in extreme minimum temperatures in the contiguous U.S.

# Measured Resiliency of Thermal Envelope to Loss of Power for Space Conditioning



**Modeled indoor temperature of five building types.**

Source: RMI (2020)

# How does insulation support resiliency?

Table 7: Select Energy Code Provisions From the 2018 IECC That Support Resilience<sup>107</sup> (2019).<sup>108</sup>

Selected Code Topic	Relevant Sections (2018 IECC)	Supported Resilience Strategy	Relevant Hazards
Insulation	C402.2, R402.2	<ul style="list-style-type: none"><li>• Passive survivability</li><li>• Reduced energy burden</li><li>• Reduced grid impact</li><li>• Reduced ice-dams</li><li>• Reduced condensation, limiting mold and mildew</li></ul>	<ul style="list-style-type: none"><li>• Extreme heat</li><li>• Extreme cold</li><li>• Snow storms</li><li>• Social resilience</li><li>• Secondary impacts to all hazards</li></ul>

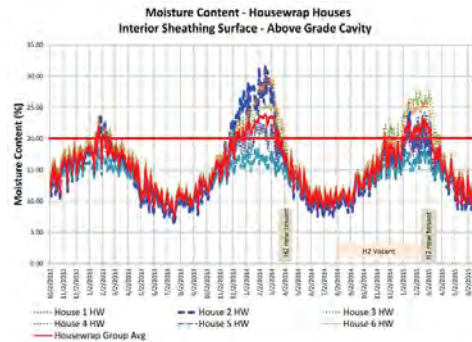
# Integrated View of Resiliency

- FPIS ci is more than just insulation for energy efficiency; it also provides...
  - extreme weather protection,
  - moisture management, and durability.
- Building codes also have robust fire safety rules for use of FPIS ci.

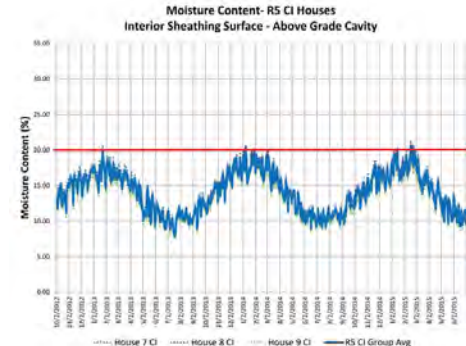


**Coordination of code provisions to mitigate potential threats.**

Source: ICC/ANCR



(A) Walls with R20 cavity insulation only consistently experiencing wet OSB.

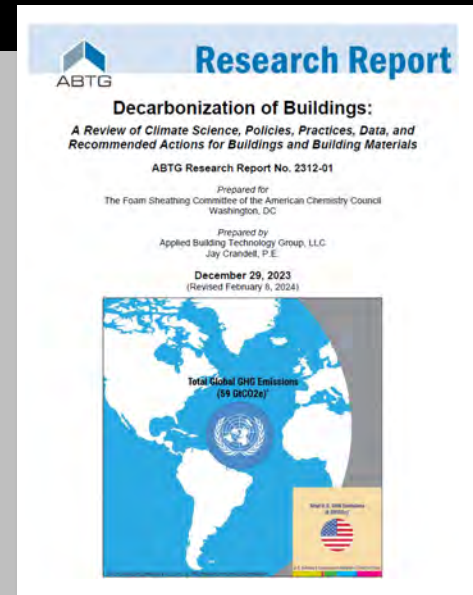


(B) Walls with R5 FPIS ci keeping OSB sheathing dry

# Total Carbon Savings of FPIS ci

## What is building decarbonization?

- Building decarbonization is one part of an overall goal to decarbonize the U.S. economy.
- It is aimed at reducing the greenhouse gas (GHG) emissions associated with buildings.
- Building materials have attributed GHG emissions (e.g., embodied emissions)
  - Quantified as global warming potential (GWP) measured as equivalent CO<sub>2</sub> emissions (CO<sub>2</sub>e)
- Building operation has attributed emissions (e.g., operational emissions)
  - Indirect from off-site electricity generation
  - Direct from on-site combustion (e.g, gas furnace)



Key resources available at:  
[continuousinsulation.org/sustainability](https://continuousinsulation.org/sustainability)

# What is the problem?

**THE PROBLEM:** GHG emissions are warming the climate and have both positive and negative impacts (net negative, although with much uncertainty and regional variation).

**THE REALITY:** Like energy efficiency, the goal of building decarbonization is faced with diminishing returns with the added complexity of deciding:

- What is significant and important to get right?
- What is insignificant in impact?
- Should we do “everything” regardless of cost or level of impact; or should we apply the 80/20 rule to identify and prioritize cost-effective actions?

To answer these important questions, we must start at the big picture...

**FACTS** | Foam Plastic Applications for Better Building

Building Decarbonization Insights  
Quantifying the Energy & Carbon Saving Benefits of Foam Plastic Insulating Sheathing (FPIS)

**WHAT IS THE PROBLEM?**

Science is foundational to our understanding of global climate change. Likewise, science should guide us to a realistic approach to mitigate climate change by the use of insulation materials to decarbonize buildings. For example, the manufacturing of all modern U.S. building insulation materials, including foam plastics, accounts for about 0.01% of total annual global greenhouse gas (GHG) emissions – also referred to as embodied emissions, 'global warming potential' (GWP), or 'carbon footprint' (see Figure 2 on page 2). Yet, these same insulation materials have a carbon-saving 'handprint' that helps to minimize the 300 times greater amount of annual GHG emissions from the operational energy use of all existing buildings in the U.S.

- What do these scientific realities mean for the climate and for the specification of insulation to help decarbonize new and existing buildings?
- How does the carbon footprint (impact) and handprint (benefit) of building insulation materials, like foam plastics, come out in the balance?

**WHAT IS THE SOLUTION?**

By putting sound science into practice, the above questions can be answered by considering the following win-win solution to building decarbonization with modern insulation materials:

- Win #1: Energy Efficiency** – All modern insulation materials play a crucial role in the energy efficiency of buildings to help reduce energy demand and facilitate an achievable, cost-effective, economy-wide transition to cleaner energy sources. (See Section 1)
- Win #2: Reduced Total Carbon Emissions** – All modern building insulation materials used to achieve Win #1 have insignificantly different GWP impacts (footprint) in comparison to their building operational carbon-saving benefits (handprint). GWP alone is an incomplete and inadequate basis for the specification of insulation materials. The carbon-saving handprint of all modern insulation materials is normally 100x greater than their comparatively small carbon material emissions footprint (see Figure 3). Furthermore, that small initial embodied carbon footprint of the insulation is typically paid back within the first year of building operation. This is true for all insulation materials, including today's foam plastics. (See Section 2)
- Win #3: Building Cost & Performance Optimization** – FPIS is somewhat unique in that it is more than just insulation and its carbon-saving benefits cannot be measured merely by its GWP. It contributes to more cost savings, energy savings, and carbon emissions reductions when its multi-functional capabilities are leveraged to optimize the design of buildings. Optimizing building assemblies with the multi-functional capabilities of FPIS is a path to even greater energy and carbon emission reductions through integrated building design efficiencies. (See Section 3)

Review "Key Take-Aways for Building Decarbonization Programs, Policies & Designs" on page 8 for implementation guidance.

For more information, visit [continuousinsulation.org](http://continuousinsulation.org)

015C23

02 | Decarbonization | 01/2024 | 015C23 Rev 1.0 | 8

Key resources available at:  
[continuousinsulation.org/sustainability](http://continuousinsulation.org/sustainability)

# The Big Picture

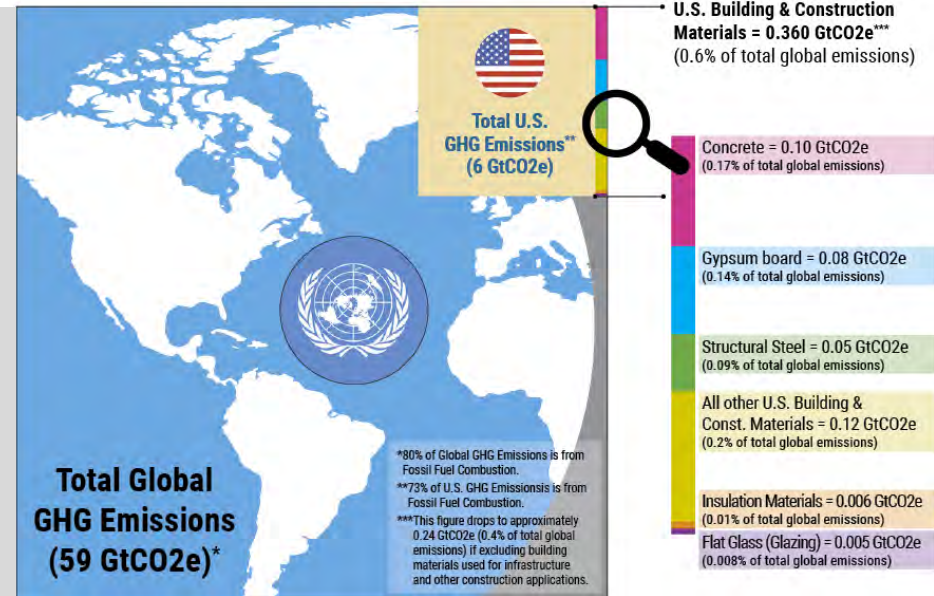
Global total GHG emissions – **59 Gt CO<sub>2</sub>e/yr**

U.S. total – **6 Gt CO<sub>2</sub>e/yr** (~10% of global)

U.S. Bldg & Const Mat'ls – **0.36 Gt CO<sub>2</sub>e**  
(~0.6% of global or ~6% of U.S.):

- **Concrete - 28% (0.17% of global total)**
- **Gypsum – 22% (0.14% of global total)**
- **Steel – 14% (0.09% of global total)**
- Insulation – 1.7% (0.01% of global total)
- Flat Glass – 1.4% (0.008% of global total)
- All other – 33% (0.2% of global total)

**1 Gt = 1 billion metric tons = 1 trillion kg = 2.2 trillion lbs**  
**1 Gt CO<sub>2</sub>e is equivalent to the combustion of 110 billion gallons of gasoline**



**Magnitude of total global and U.S. GHG annual emissions, and contribution of U.S. Building & Construction Materials to total global GHG emissions.**

SOURCE: ABTG Report, [Decarbonization of Buildings](#), Figure A & Table A.

# KEY TAKE-AWAYS

- About three-quarters of U.S. (and 80% of global) GHG emissions are CO<sub>2</sub> emissions from combustion of fossil fuels in all sectors of the economy (transportation, industry, buildings, electricity generation, etc.).
- Eliminating all emissions of all U.S. building and construction materials would have a climate impact of about 0.6% (or 6/1000'ths) of total global GHG emissions.
- The top three building and construction materials account for about two-thirds of all U.S. building and construction material emissions (~0.4% of total global GHG emissions).
- All modern building insulation materials produced in the U.S. each year, including foam plastics, account for 0.01% (or 1/10,000'ths) of annual total global GHG emissions.
- Yet, when insulation materials are used in buildings to conserve energy, they help offset the annual operational carbon emissions of all buildings in the U.S., which is 300x greater than the annual emissions from the manufacturing of insulation.

# What is the Solution?

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Successful building decarbonization comes in three categories of “**WINS**” supported by the use of modern insulation materials, like FPIS ci:

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**WIN #1:** Energy efficiency

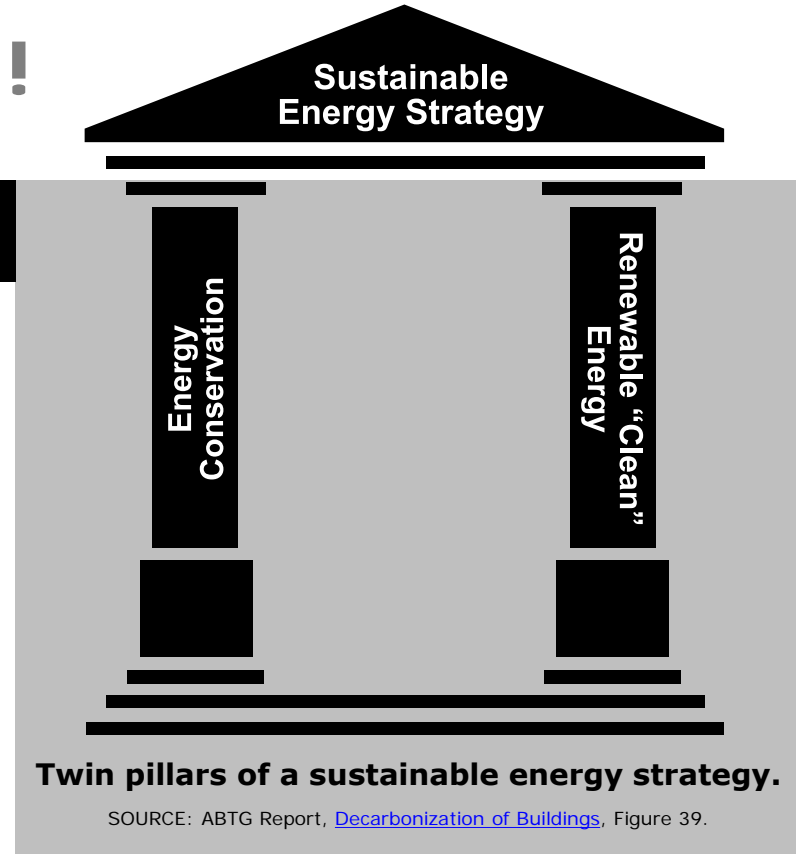
**WIN #2:** Reduced total carbon emissions

**WIN #3:** Building cost & performance optimization

# WIN #1: Efficiency First!

## Building energy efficiency is many things...

- The lowest-cost, zero-carbon “fuel” because energy not used has no cost and no emissions
- One of two key “pillars” of a sustainable energy strategy by conserving energy and reducing the demand for energy of all types, including renewable “clean” energy.
- The foundation of increased energy productivity to deliver building function with less energy consumption.



# WIN #1: Efficiency First!

## Building energy efficiency is many things...

- Affordable because it reduces energy bills and provides continual “pay-back” over the life of a building and all its future owners and uses.
- Lowers peak demand on the electric grid enabling efficient transition to renewable energy sources.
- Helps achieve energy security because the safest energy supply is energy that is not needed.



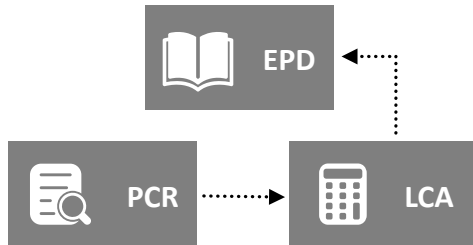
**EXAMPLE:** For mortgaged homes, the portion of the downpayment for insulation is recouped within the first year of building use after which there is a net positive cash flow for the insulation portion of the initial building cost. Consequently, a \$400 downpayment for improved energy efficiency features of a typical home can yield \$14,500 savings over the period of a 30-year mortgage based on ACC Fact Sheet “Energy Efficiency = Healthy Return on Investment.”

# WIN #2: Reduce Total Carbon Emissions

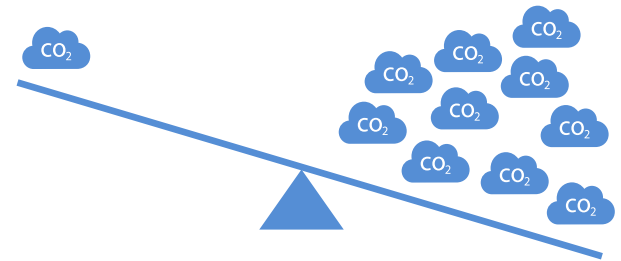
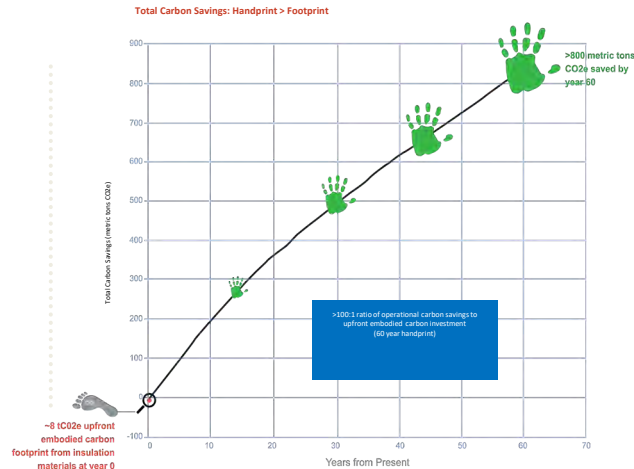
## What is "total carbon" in the context of a building material?



Total carbon of a material evaluates the net GHG emissions from a product or material's embodied carbon and emissions savings attributed to the operational carbon benefits realized after installation and during the building's use.

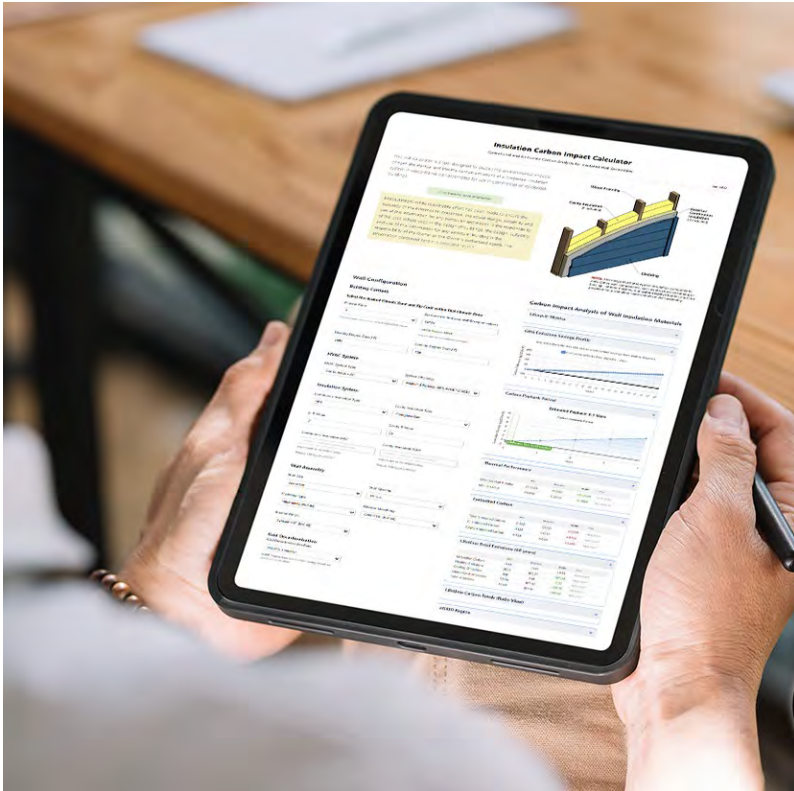


Product Category Rules (PCR) dictate the completion of a valid material or product life cycle assessment (LCA) and environmental product declaration (EPD).



Source: <https://www.americanchemistry.com/better-policy-regulation/plastics/resources/the-benefits-of-a-whole-building-lca-or-total-carbon-analysis>  
(Prepared by WAP Sustainability for ACC)

# Insulation Total Carbon Calculator



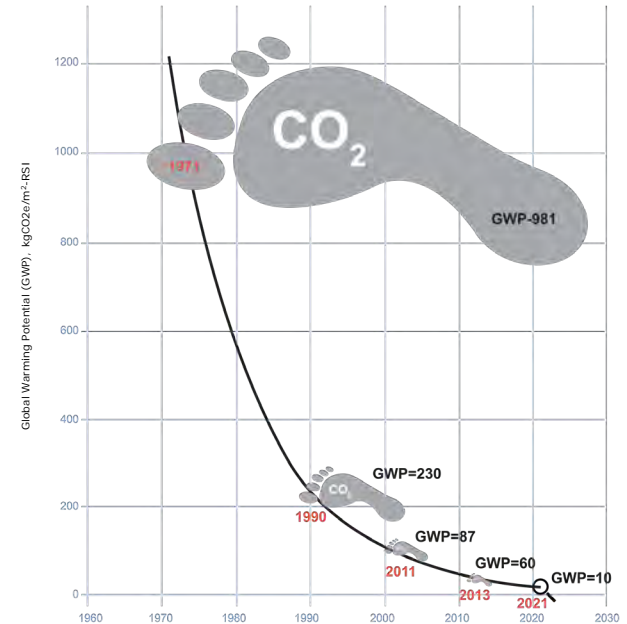
This new tool gives builders, designers, and energy professionals a clear, data-driven way to evaluate the total life cycle carbon performance of insulation used in wood frame wall assemblies.



# WIN #2: Reduce Total Carbon Emissions

- Insulation materials, like other building materials, have an embodied carbon “footprint” (albeit very small).
- But, unlike other materials, insulation has a “handprint” that saves energy and carbon emissions over the life of a building.
- In particular, U.S. manufacturers of modern foam plastic insulation materials have invested in substantial reduction of material (embodied) carbon emissions over the past several decades and even the past several years (see figure).
- All modern U.S. FPIS products (Polyiso, EPS, and XPS) generally have a GWP ranging from about 3 to 8 for typical wall applications.
- All are now considered low-carbon insulation materials and differences are negligible in terms of “total carbon” performance...

FPIS Material Innovations = Reduced Carbon Footprint

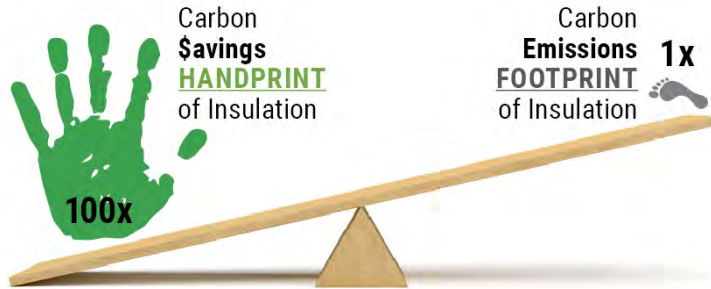


# WIN #2: Reduce Total Carbon Emissions

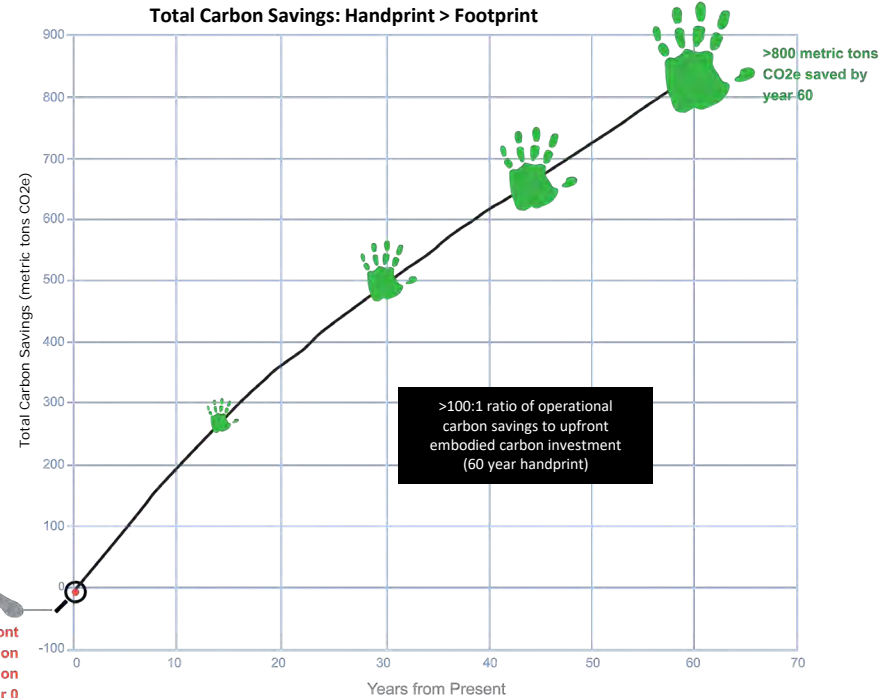


In a typical new building complying with modern U.S. energy conservation codes, the use of foam plastic insulation materials results in GHG emissions savings that is 100x the embodied carbon footprint of the whole insulation package for the building's thermal envelope.

**NOTE:** This can vary from 30x to 300x depending on various factors (HVAC system/fuel type, regional electric grid, etc.)



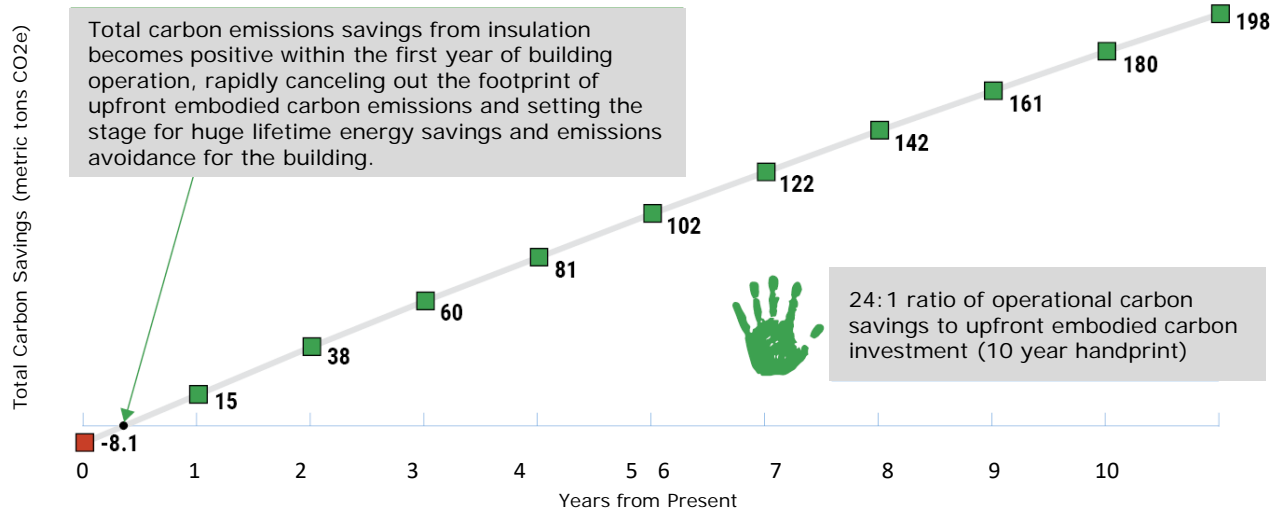
When used in a typical new building, the carbon savings “handprint” of building insulations, like foam plastics, outweighs its carbon emissions “footprint” by 100x.



# WIN #2: Reduce Total Carbon Emissions

The carbon payback is almost immediate in typical building applications – within one year (or months) the insulation provides a net savings in total carbon emissions!

## Carbon Emissions Payback



FPIS and other foam plastic building insulations pay back the initial upfront embodied carbon within the first year of building operation (see green arrow). This payback period is comparable to that of wind turbines for renewable electricity generation. Within 10 years, the operational to embodied emissions savings ratio of the building insulation materials reaches 24:1 for immediate climate change mitigation with continued savings for additional long-term benefits.

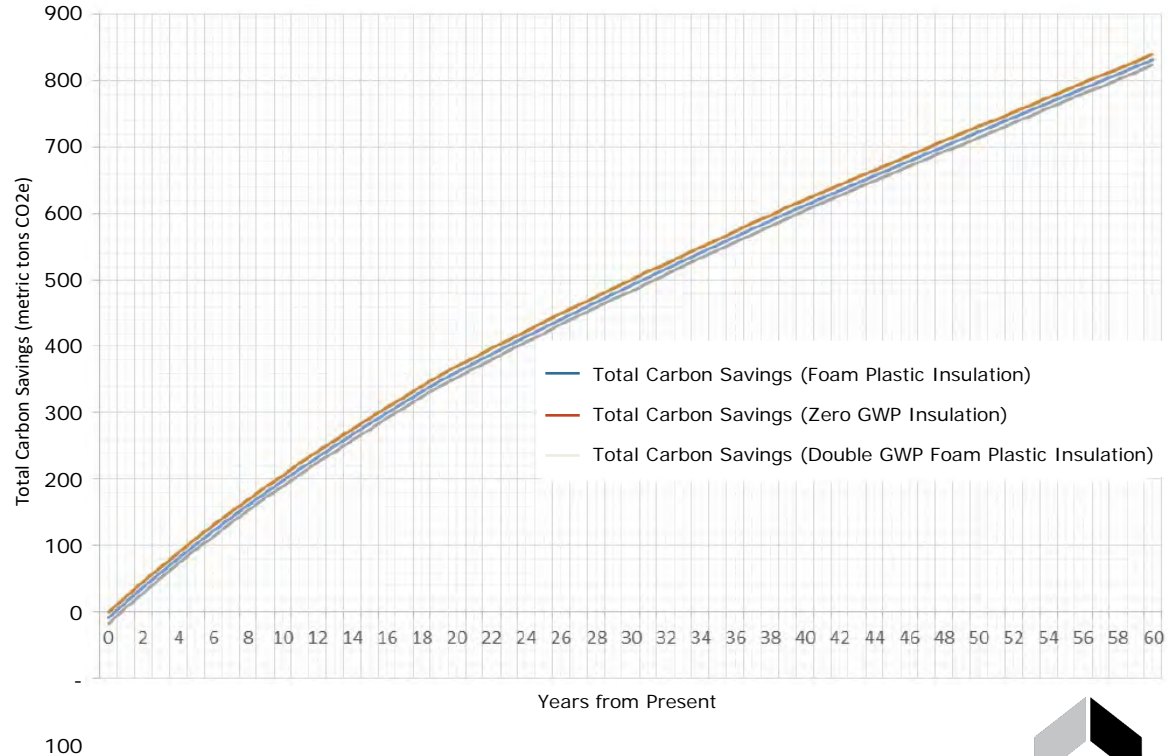
# WIN #2: Reduce Total Carbon Emissions

The total carbon emissions savings benefit of modern insulation materials is negligibly different because they all have relatively small embodied carbon in comparison to the huge operational carbon savings they deliver!

This graph compares the difference in building total carbon emissions savings for a range of modern insulation materials with GWP ranging from 0 (i.e., bio-based) to 10 (e.g., high end of modern foam plastics) — and even double that!

The carbon savings are huge and negligibly different in all cases because all modern insulation materials have a low-range of GWP and deliver large energy and carbon emissions savings.

## A Key Material Comparison Take-Away



# KEY TAKE-AWAYS

- All modern insulation materials, including FPIS ci, are “low carbon” solutions with fast carbon payback delivering large (e.g., 100x) life cycle carbon emissions savings.
- The differences in GWP of modern building insulation materials are practically negligible when properly viewed from a “total carbon” analysis (footprint + handprint).
- Specification of insulation materials and methods should focus on performance and functional optimization and this leads to Win #3...

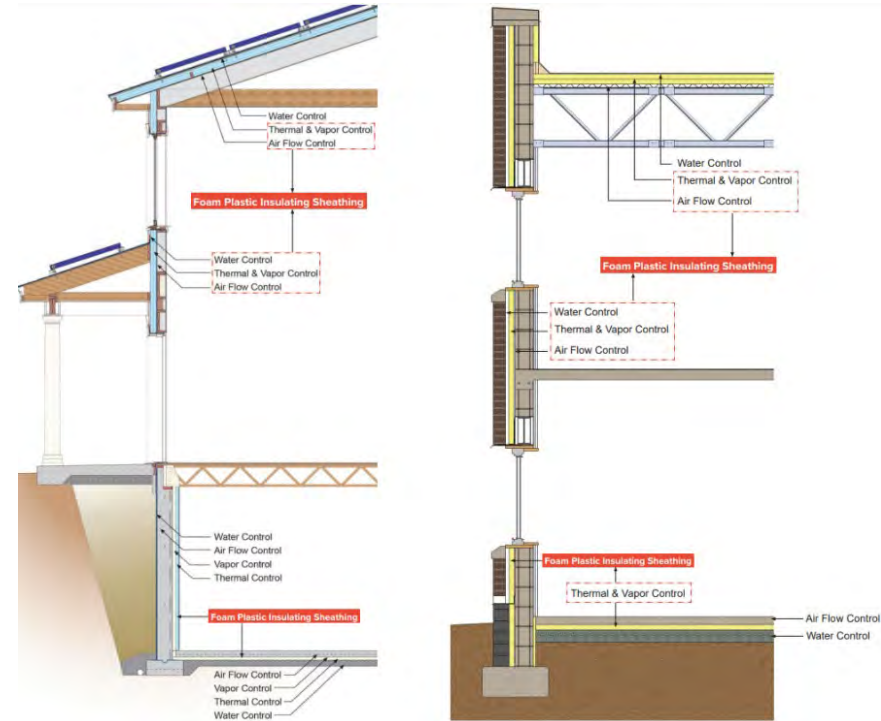
# WIN #3: Building Cost & Performance Optimization

Multi-functional applications and capabilities of FPIS ci for building thermal envelopes:

- **Applications:** walls, roofs, floors, and foundations (residential and commercial)
- **Functional Capabilities:**
  - IECC: Continuous insulation (ci)
  - IECC: Air barrier (AB)
  - IBC/IRC: Water vapor control/retarders (VR)
  - IBC/IRC: Water-resistive barrier (WRB) system
  - IBC/IRC: Foundation/footing frost protection
  - IBC/IRC: Wall bracing (structural insulating sheathing)

Leveraging multi-functional capabilities:

- + satisfy multiple code requirements
- + simpler assembly
- + material/resource/design efficiency
- + reduced carbon emissions
- = **optimized value** (cost & performance)



Source: [www.continuousinsulation.org](http://www.continuousinsulation.org)

# FPIS ci Optimization Case Study

## Single family home built to IRC and IECC

### Walls

FPIS ci used as:

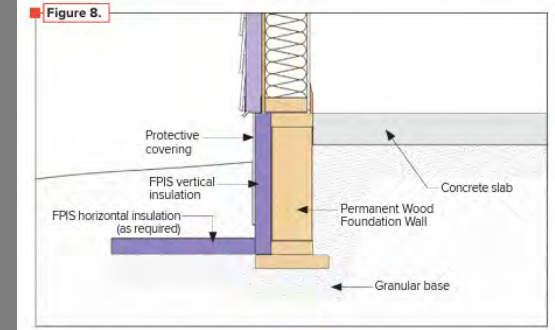
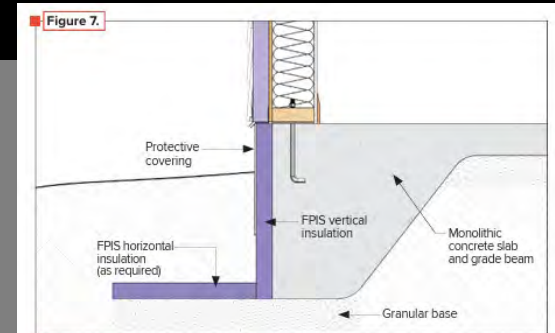
- Continuous insulation
- Water-resistive barrier
- Air-barrier assembly (plus wall bracing optimized)

### Foundation

FPIS used for frost-protected shallow foundation

### RESULTS:

- Net embodied carbon reduced by >2.5 tons CO<sub>2</sub>e (reduced concrete, no separate AB/WRB, use interior paint as VR)
- Energy efficiency improved above code minimum (with improved “resiliency” and reduced operational emissions)
- Construction cost reduced \$8,900.




# FPIS ci Optimization Tools

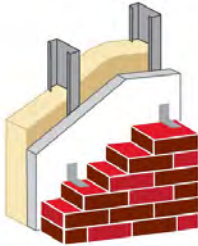
**Design Guide for Above-grade Walls with FPIS ci**

Home

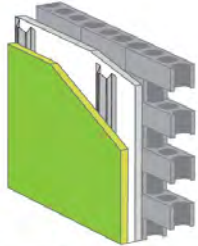
Select your wall type to begin a step-by-step design sequence to help you develop a code-compliant, high-performance wall suitable to your specific project:



Wood Framing



Steel Framing



Concrete/Masonry - Coming Soon!

## Wall Assembly Inputs

### 1. Building / Energy Code & Year

Energy code & year

2021 IRC + IECC-R

Requirements are based on unamended versions of the indicated model codes and standards and do not account for possible state/local amendments which the user must assess.

### 2. Climate Zone and Heating Degree Days

Climate zone

5

Enter Heating Degree Days (HDD) if you want the minimum Insulation Ratio (Re/Ri) to be based more efficiently on heating degree days, rather than strictly on the climate zone maximums. This can be especially beneficial in colder climate zones. Values outside the range shown will be ignored. The heating degree days option is only available for some climate zones. HDD values are on a 65°F basis.

Heating degree days (5400 - 7200) (Optional)

## Output

### Energy Code Check: Thermal Performance

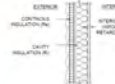
The wall assembly is compliant if it passes either the R-value or U-factor check.

Compliance Method	Proposed Wall (Zone 5)	Code Requirement (Zone 5)	Check
Insulation Component R-values	R20+G1	R30 or R20+G1 or R13+G1 or R5+G1	PASS
Assembly U-factor	0.045 Effective R-value: 22.22	0.045 Effective R-value: 22.22	PASS
Compliant	-	-	PASS

\*Requirements are based on unamended versions of the indicated model codes and standards and do not account for possible state/local amendments which the user must assess.

### Water Vapor Control Check Option 1: Insulation Ratios (Re/Ri)

This check determines which classes of interior vapor retarders are compatible with the proposed wall assembly for walls incorporating continuous insulation on the exterior. See the diagram for the location of the interior vapor retarder, and see options below for compliance.



Interior Vapor Retarder Class <sup>1</sup>	Proposed Ratio	Minimum Ratio Required (Zone 5)	Check
Class 1	0.25	0.20	PASS
Class 2	0.25	0.20	PASS
Class 3	0.25	0.31	FAIL
No interior VR <sup>2</sup>	0.25	1.50	FAIL



Find free wall calculators for energy and building code compliance at [continuousinsulation.org/calculators](https://continuousinsulation.org/calculators)

# Actionable Resources for FPIS ci



**Foam Plastic Applications  
for Better Building**

## Continuous Insulation **RESOURCE GUIDE**

FACTS Sheets & Quick Guides  
for Code-Compliant  
Applications of Foam Plastic  
Insulating Sheathing (FPIS)

[continuousinsulation.org](http://continuousinsulation.org)



Revised January 2025 to reflect 2024 I-Codes.

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6300 Enterprise Lane  
Madison, Wisconsin 53719  
608-310-8710

### ANSI/ABTG FS200.1 – 2022

#### Standard for Use of Foam Plastic Insulating Sheathing (FPIS) in Building Envelopes: Above-grade Walls



For additional information refer to:  
<https://www.continuousinsulation.org/applications>

# CONCLUSIONS

## **FPI S products are:**

- **Energy efficiency solutions** meeting modern energy code continuous insulation and thermal bridging mitigation requirements.
- **“Low carbon” building materials** (GWP < 10)
- **Total carbon saving solutions** for building decarbonization and climate change mitigation
- **Multi-functional components** that help optimized building assemblies for performance and cost
- **A mature building technology** (75 years of application and advancement) and supported by actionable design, construction, and code compliance resources.

**Thank you for participating!**  
**Questions?**



[continuousinsulation.org](http://continuousinsulation.org)