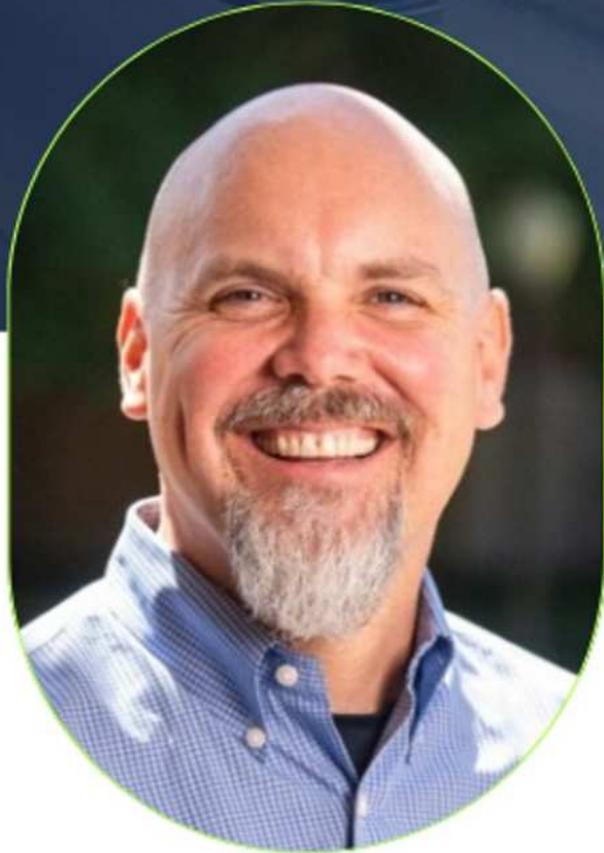


Sustainability-Driven Building Practices: Aligning Stakeholder Needs and Maximizing Return Through Continuous Improvement

Todd Usher, William Ranson, Adam Broderick





Todd Usher, PhD

Founder & President



William Ranson

Building Knowledge Center
Leader



Adam Broderick

Material Scientist
Product Innovation and Development



Framing the Sustainability Challenge



OUR SUSTAINABILITY STRATEGY

OUR PLANET IS OUR "HOME," AND THERE IS NO PLACE LIKE IT.

We focus on working with the industry to deliver innovative solutions that protect our planet by driving whole life carbon of buildings to net zero, increasing circularity of materials, and utilizing chemistries that are safe and sustainable by design to realize our shared vision of a sustainable "home" where current and future generations can thrive.

OUR 2030 GOALS

Sustainability Goals for DuPont Shelter Solutions



DELIVERING SOLUTIONS FOR GLOBAL CHALLENGES

We will deliver innovative construction solutions that enable the energy efficiency, weatherization, and fire resilience of buildings, while improving the productivity and quality of the installation.



ACTING ON CLIMATE

We will reduce Scope 1 and 2 GHG emissions from DuPont Performance Building Solutions and Corian® Design operations by 75% from a 2019 baseline.



SAFE AND SUSTAINABLE BY DESIGN

We will collaborate with our customers and key partners to bring green chemistry innovations to the market and will drive continued reduction in the presence of substances of concern in our portfolio.



ENABLING THE CIRCULAR ECONOMY

We will advance the circular economy in the building industry through innovation in materials and business models, collaboration, and end-of-life plans that eliminate and up-cycle waste across the product life cycle.



BUILDING THRIVING COMMUNITIES

We will strengthen families and empower the next generation through fostering inclusivity, partnerships, and employee volunteerism globally.

Framing the Sustainability Challenge

Sustainability:

Meeting the needs of the present without compromising the ability of future generations to meet their own needs.

1987 Brundtland Commission Report, United Nations

What are the current needs of your clients?



“Present”

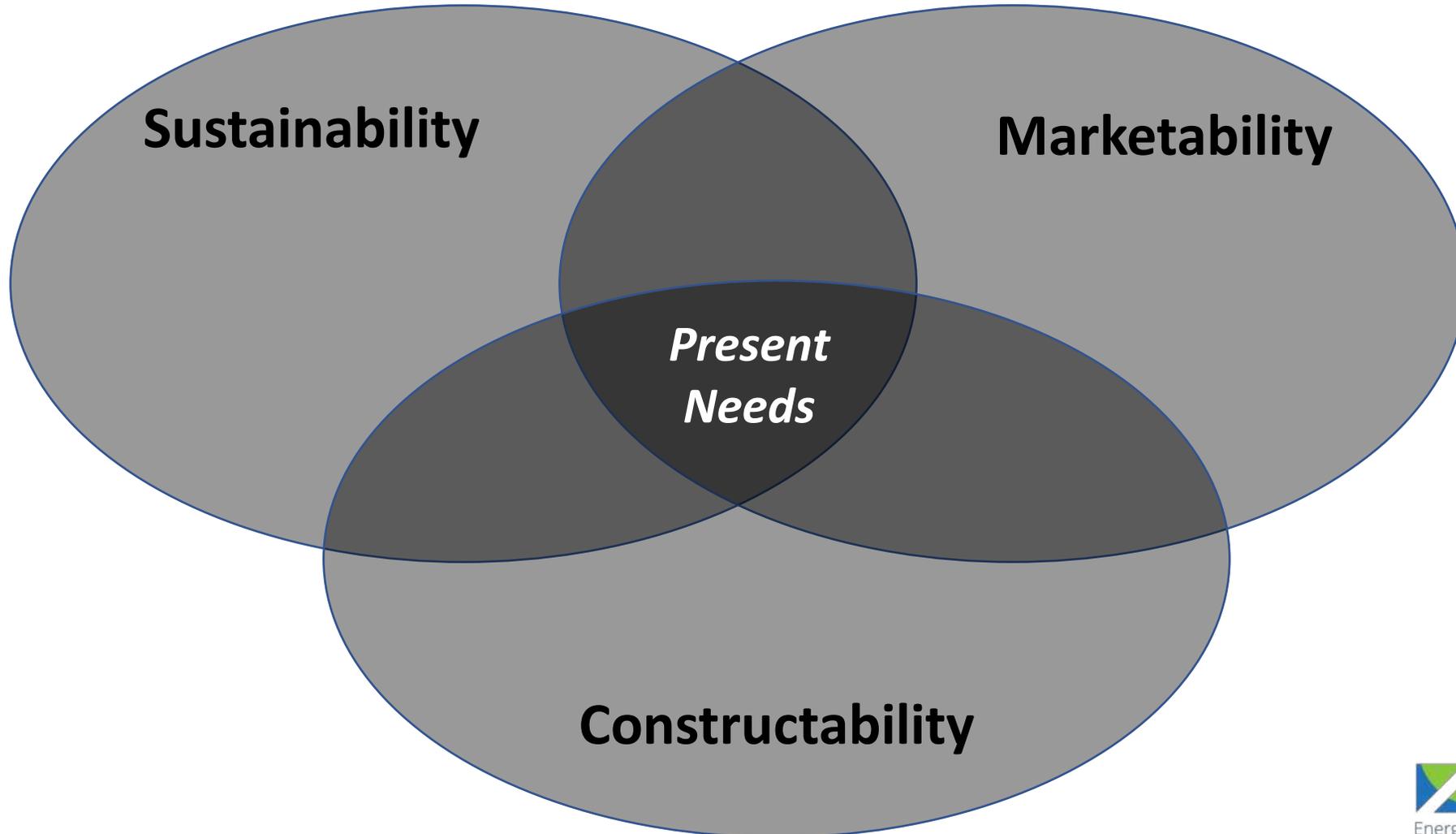
How does the home you build affect:



“Future Generations”

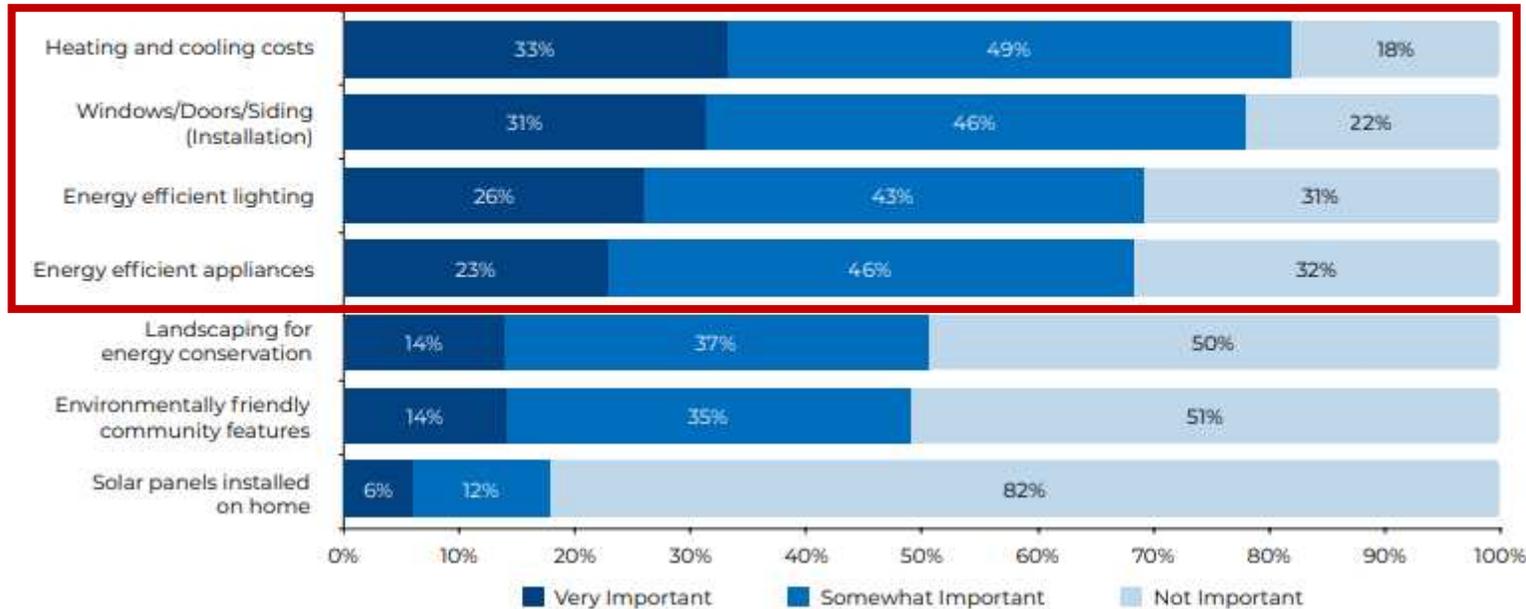
Are you building a durable product that you will be proud to show your great grand kids?

Sustainability: Only One Piece of the Puzzle



Present needs: What are people asking for?

Exhibit 2-20 Importance of Home's Environmentally Friendly Features
(Percentage Distribution)

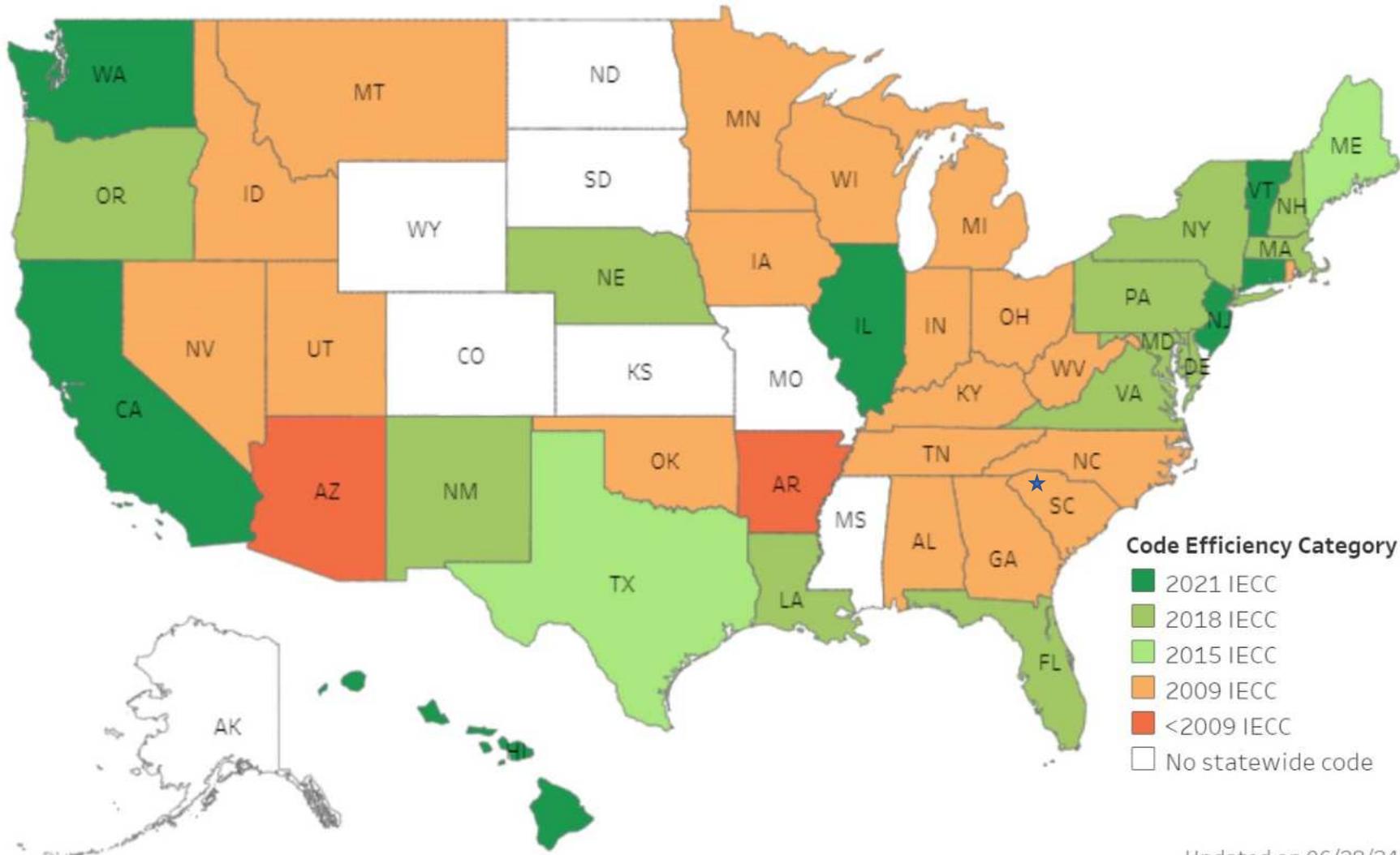


Survey: Most important attribute of home

New Homes: Avoid renovations or issues with plumbing or electricity (45%)
“High Quality Home”

Used Homes: Meet price expectations (38%)
“Affordable Home”

Codes (generally) do not meet present needs



Framing the Sustainability Challenge



Estimated Improvement in Residential & Commercial Energy Codes (1975 - 2022)



*Net energy use includes the contribution of renewable energy generation

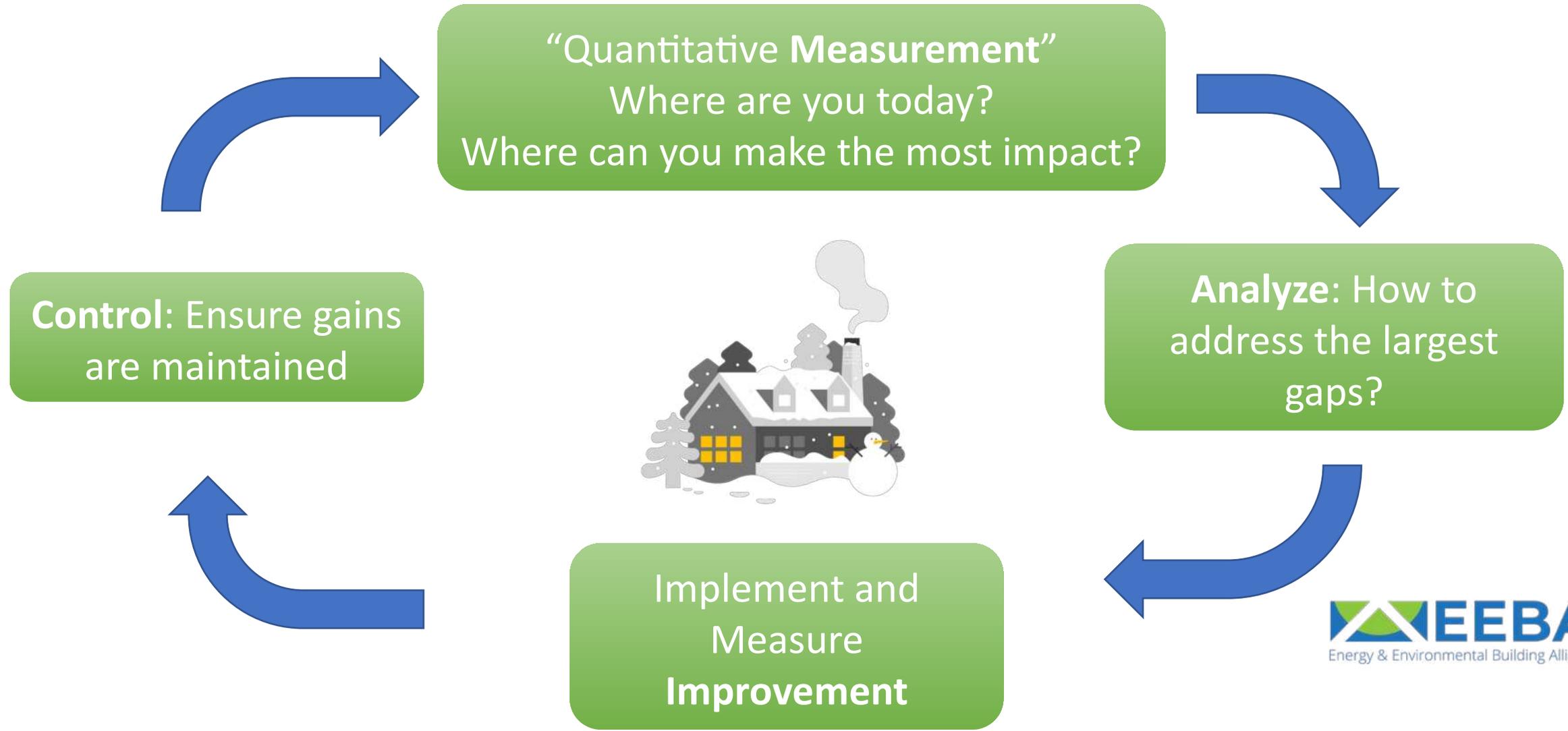
<https://www.energycodes.gov/state-portal>



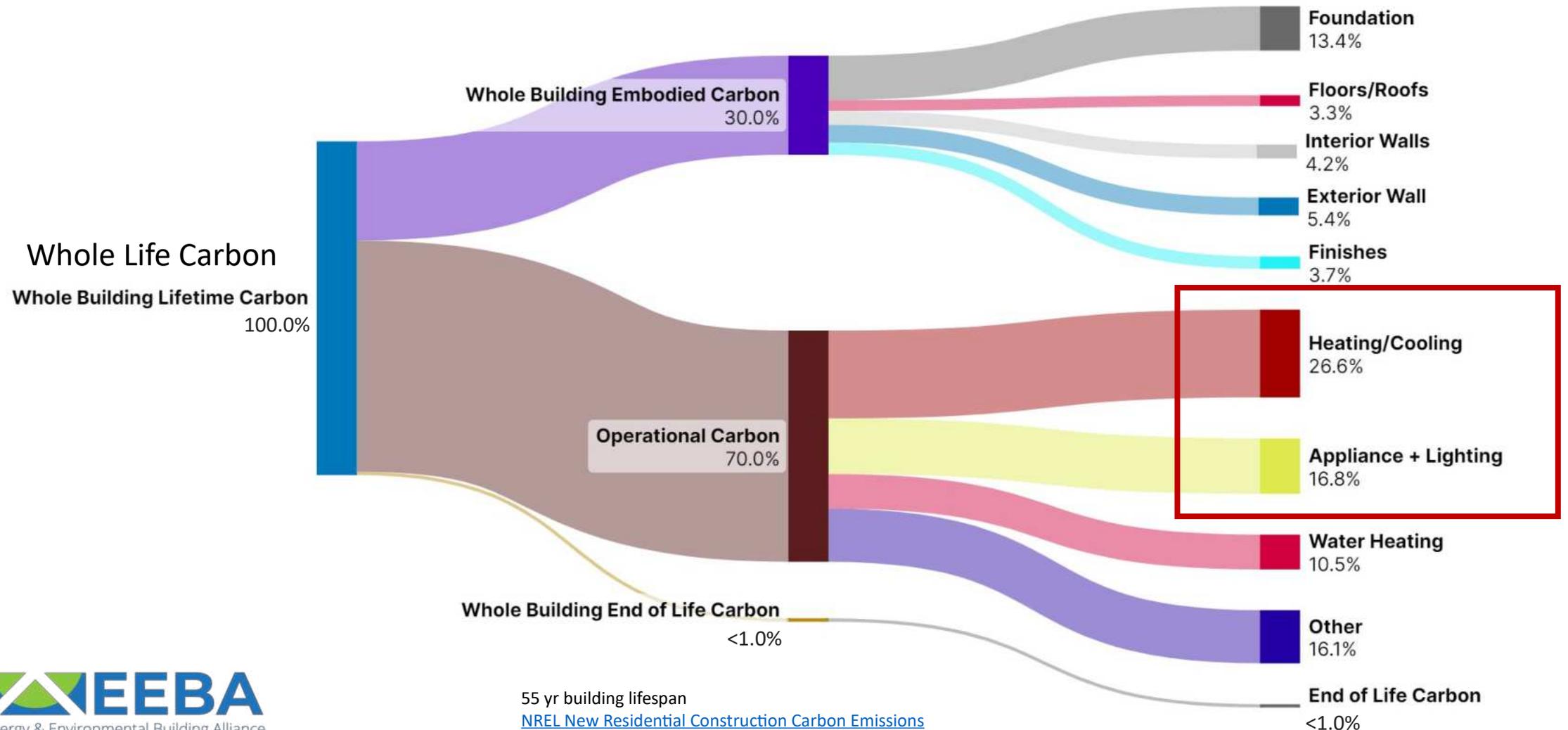
Continuous Improvement Methodology



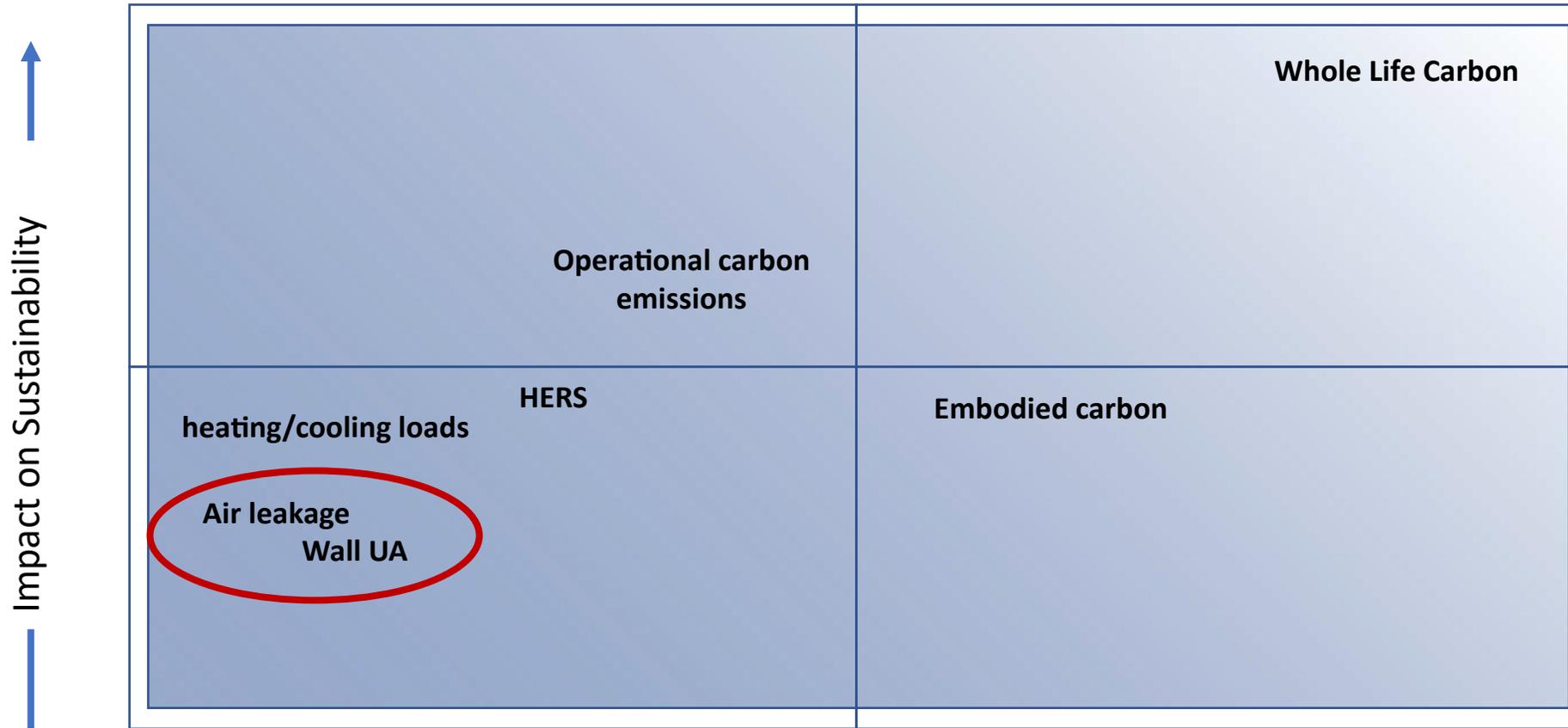
Continuous Improvement Methodology



Tracking Carbon- Where to make impact?

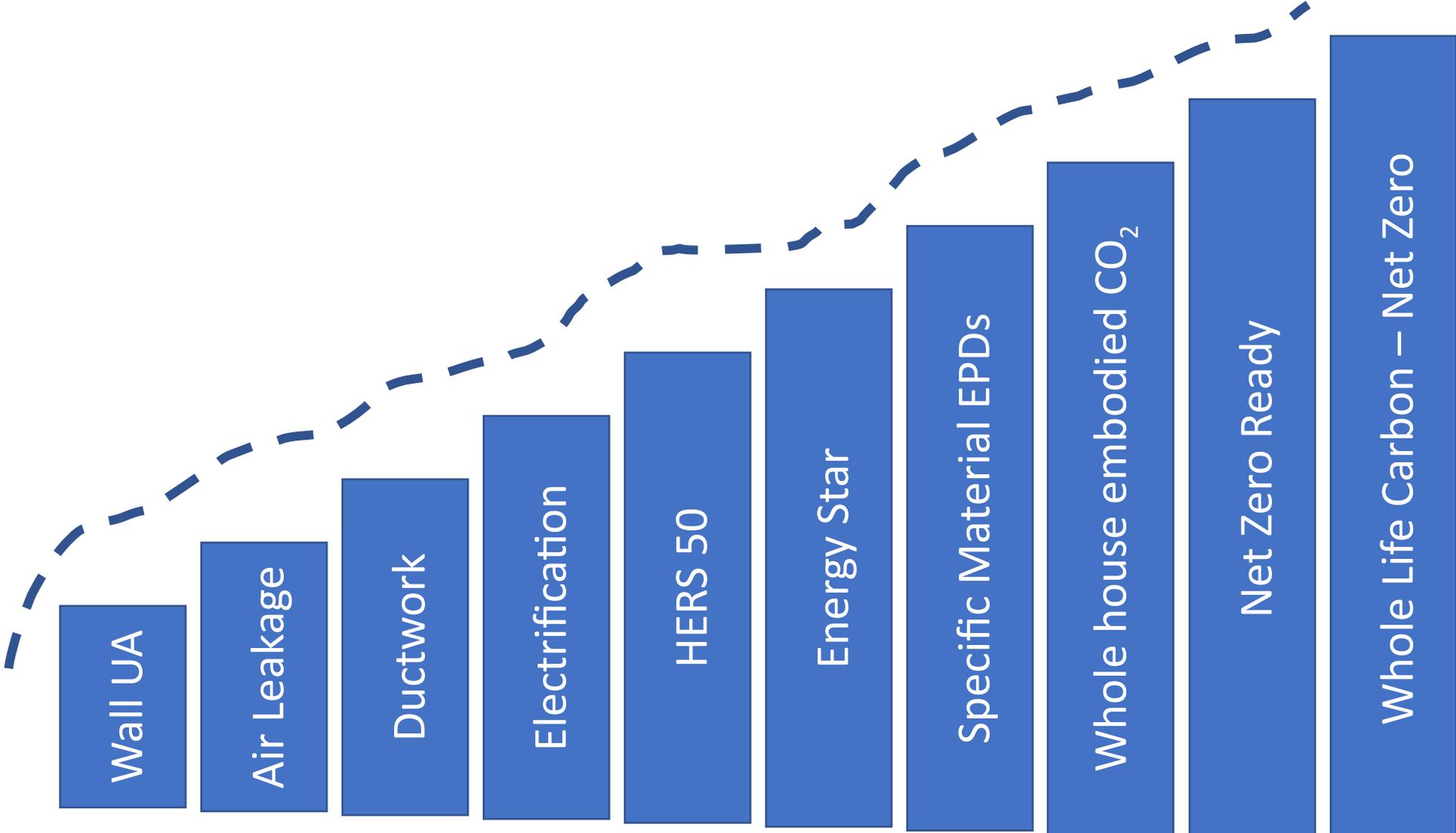


Which metrics to choose?



Difficulty to Implement →

Stair Step - Taking small bites



Example: Impact Tree for Air Leakage

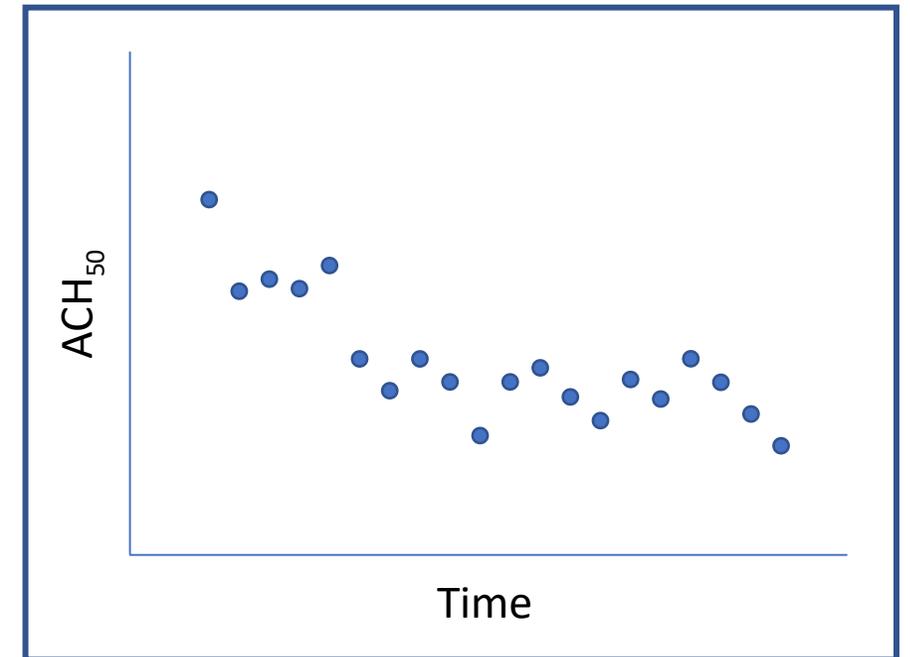
Quantitative Metrics with Clear Sustainability Implications

Whole Building
Lifetime CO₂

Operational
Carbon

Heating/Cooling
Loads (Manual J)

Air leakage



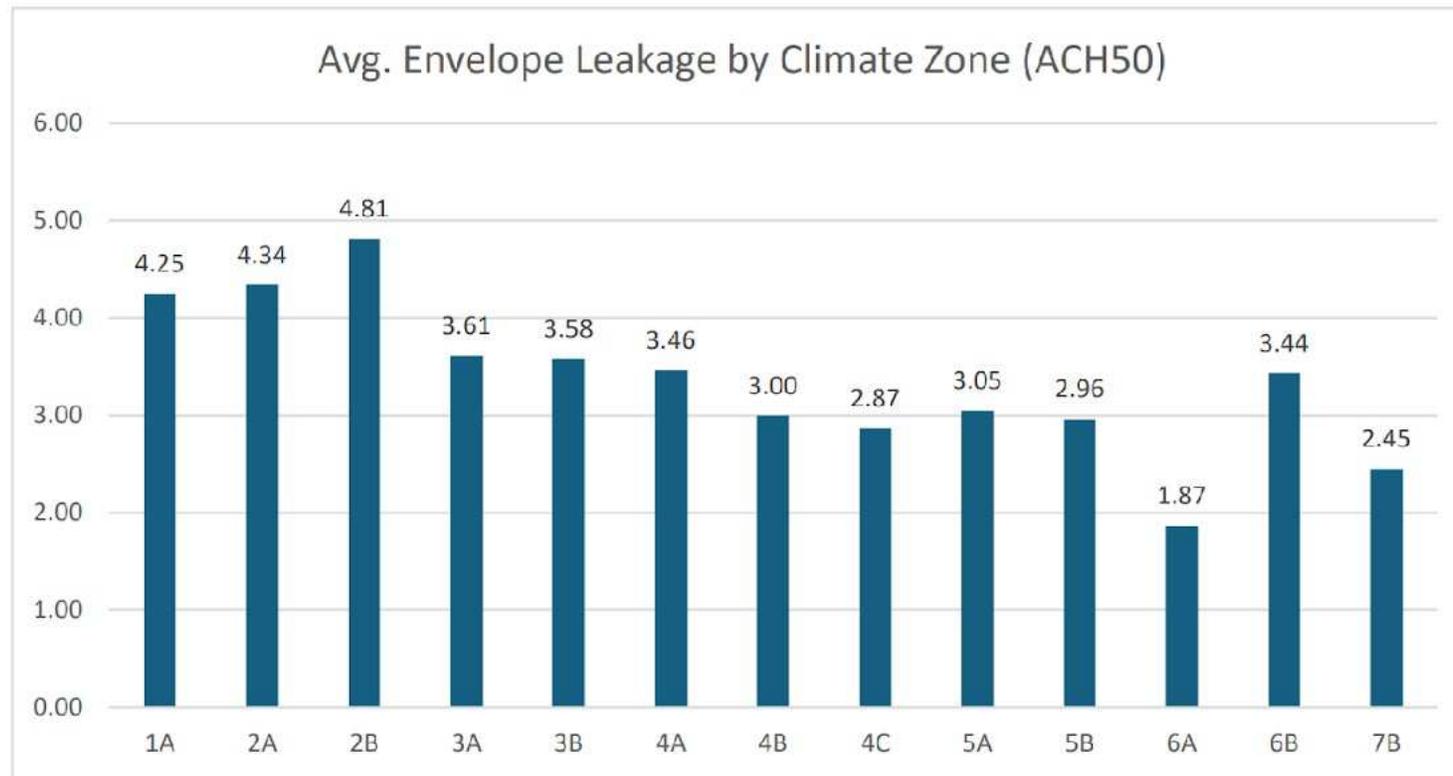
Manual J includes:

- Air leakage (ACH50, CFM50)
- Thermal Envelope
- Window Characteristics

- Floor plan (# stories, area)

Make an impact – Air Leakage

Where do you stand relative to peers? (ACH50, CFM50)



- *2024 Trends in HERS(R) rated homes, a statistical abstract.*

Where and how to air seal?

§R402.4.1.3

Air Leakage Rate	Climate Zone	Test Pressure
≤ 5 ACH	0-2	50 Pascals
≤ 3 ACH	3-8	50 Pascals

- Proper air sealing the **top plate to attic drywall** can have the **greatest** impact of all locations, with a potential ACH50 reduction of up to 1.6 exchanges.

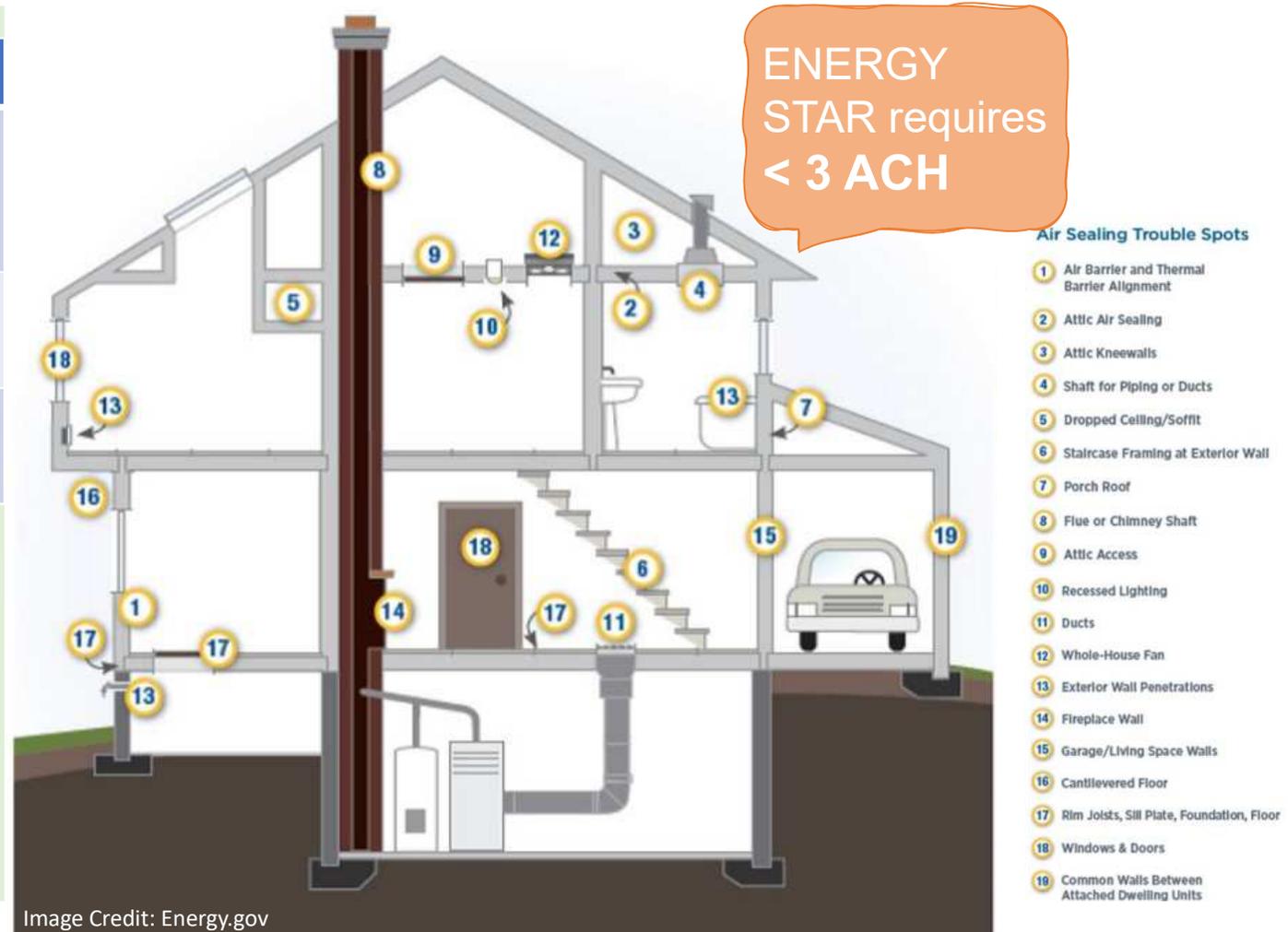


Image Credit: Energy.gov

How to improve your air sealing?

Install your WRB as an air barrier!

Tape ALL Seams

Top and Bottom of Wall

How you handle penetrations?

Watch for tricks:

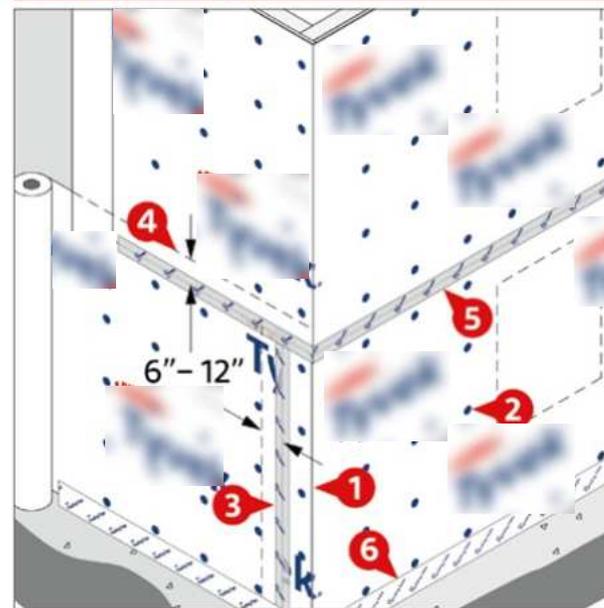
- garage to attic
- attic knee wall
- Cantilevers

Single-Family Field Installation Examples: DuPont™ Tyvek® WRB Installation and Continuity

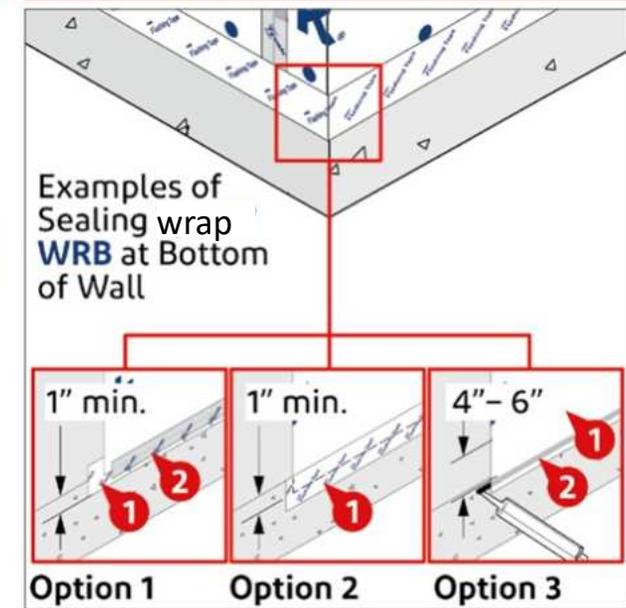
This document is designed to serve as a resource. The examples provided do not override or change any requirement in the currently published Installation Guidelines or Warranties. For complete details, always refer to the applicable Installation Guidelines and Warranties, available at www.dupont.com/building/how-to-install.html. Scan the QR code for quick and direct access.



Tyvek® WRB Installation for New Construction



Base of Wall



Make an impact: Thermal Wall UA values

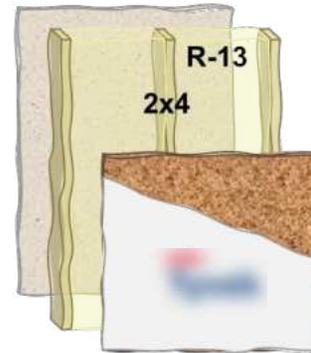
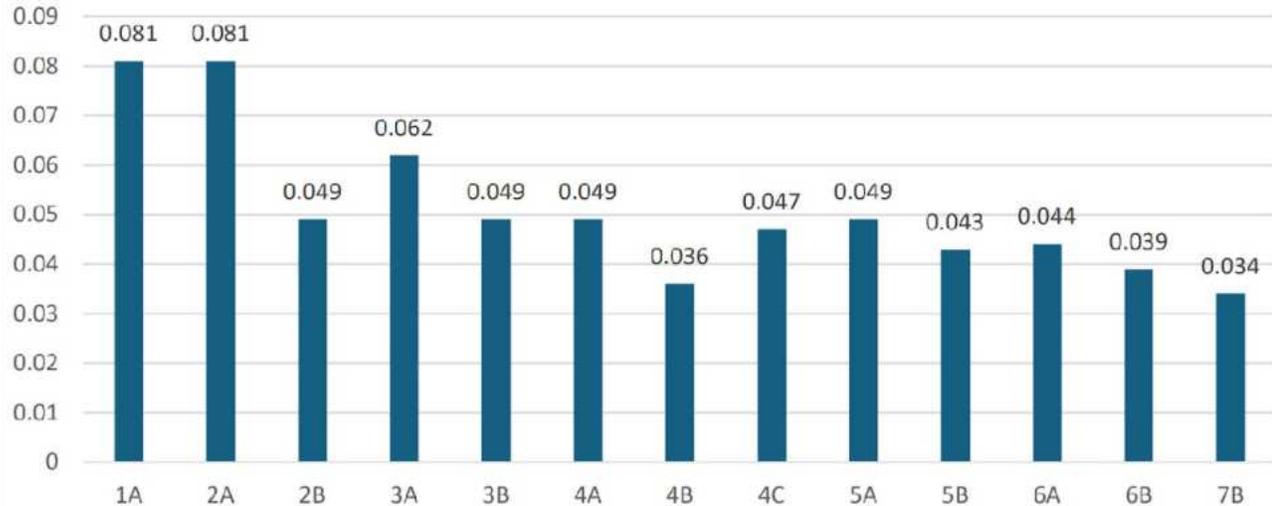
R-value: Blocking heat



U-factor: Sum of all leaks

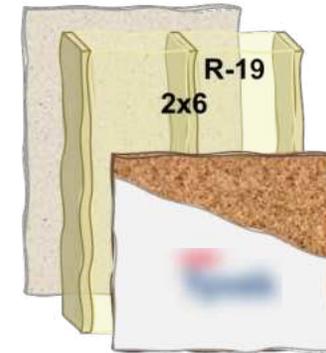


Average Above Grade Wall U_o Value by Climate Zone (2023)



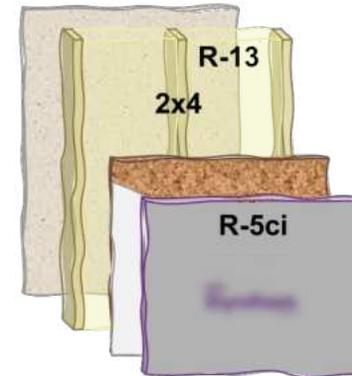
U value= 0.101

Effective
R-9.9



U value= 0.071

Effective
R-14.1



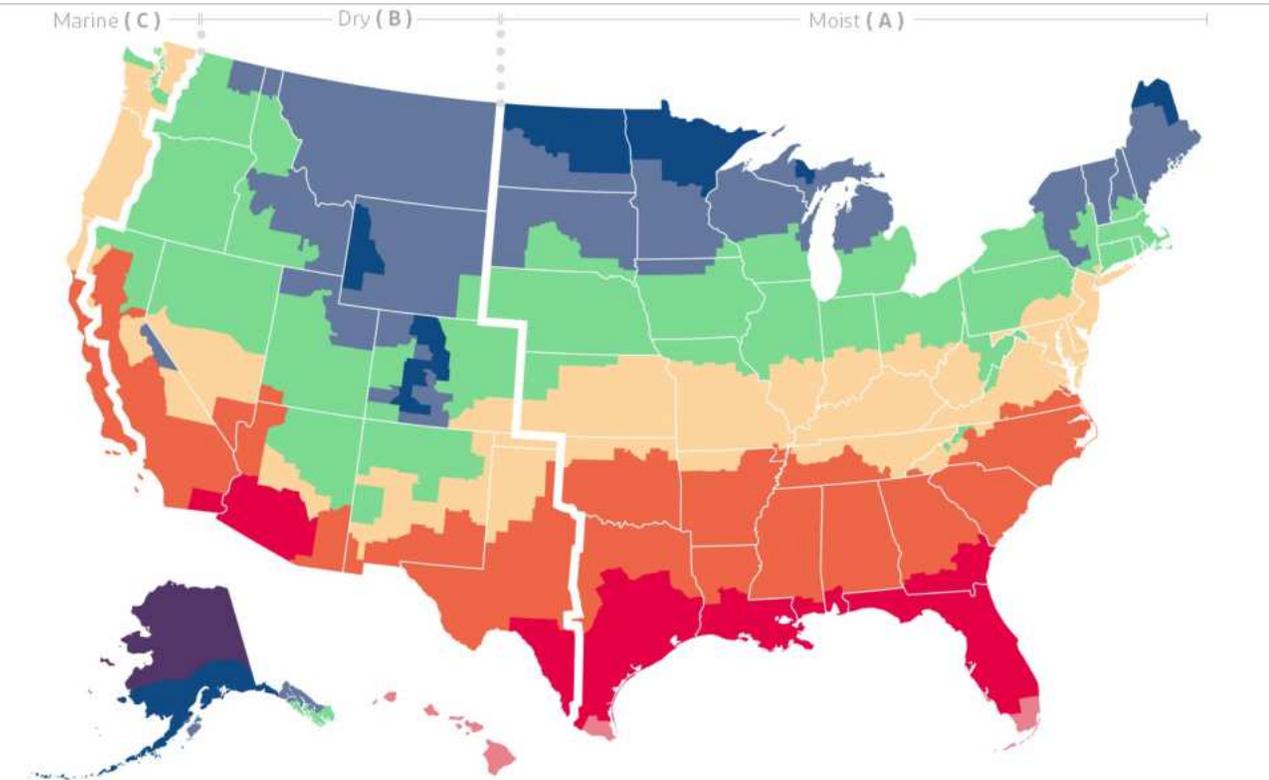
U value= 0.067

Effective
R-14.9

UA takes into consideration : Framing (size, advanced?), window U, Window to wall ratio, insulation (batt, CI), and area

How to Improve Thermal Wall : CI

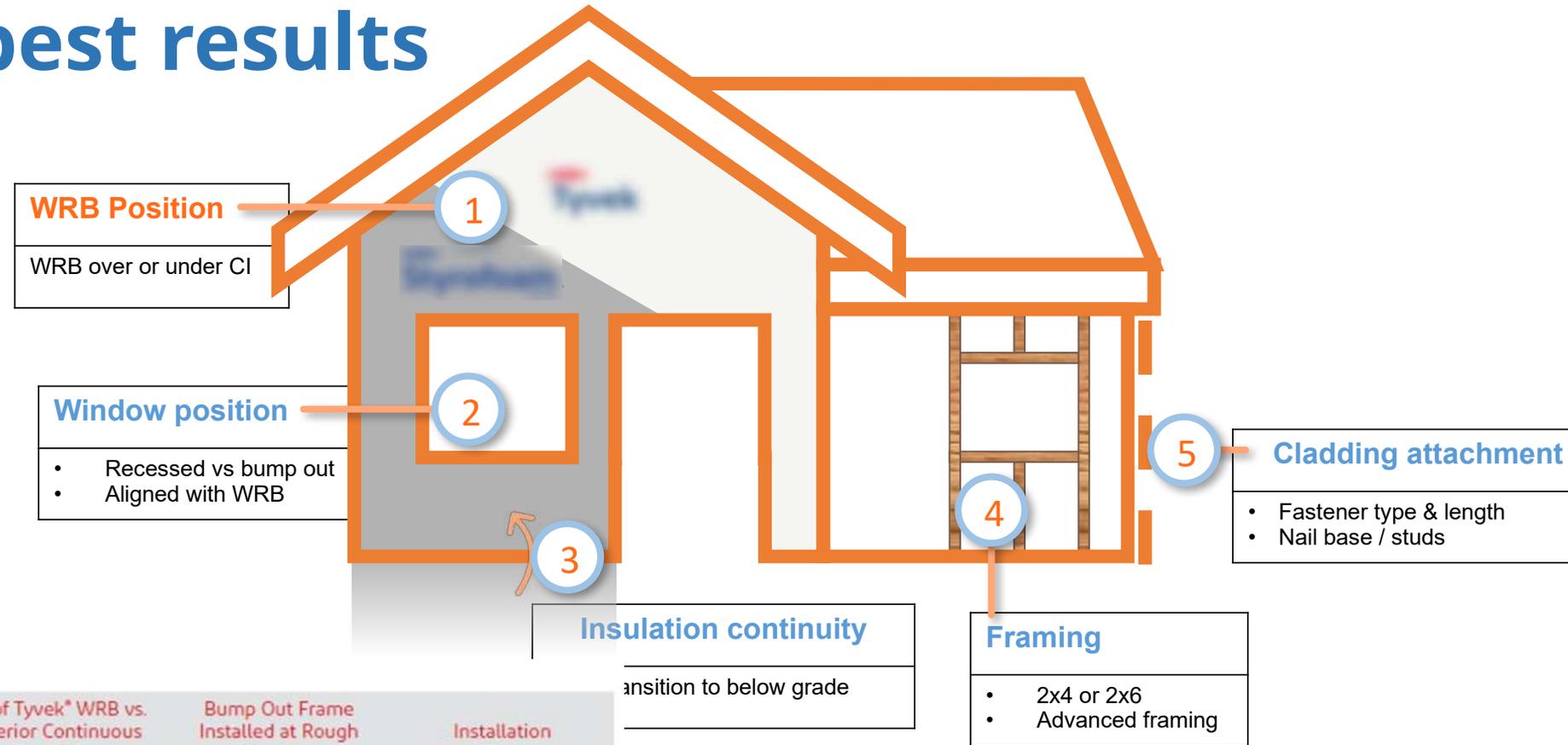
2021 IECC Prescriptive R-Value Requirements: *Residential Wood Frame Walls*



2021 IECC R-Value Prescriptive Requirements Wood-Framed Wall		
Climate Zone	2x4 Options	2x6 Options
8	30 or 13+10ci or 0+20ci	30 or 20+5ci
7	30 or 13+10ci or 0+20ci	30 or 20+5ci
6	30 or 13+10ci or 0+20ci	30 or 20+5ci
5	30 or 13+10ci or 0+20ci	30 or 20+5ci
4	30 or 13+10ci or 0+20ci	30 or 20+5ci
3	20 or 13+5ci or 0+15ci	20
2	20 or 13+5ci or 0+15ci	20
1	13 or 0+10ci	

Orange = More stringent vs 2018 IECC

CI tips for best results



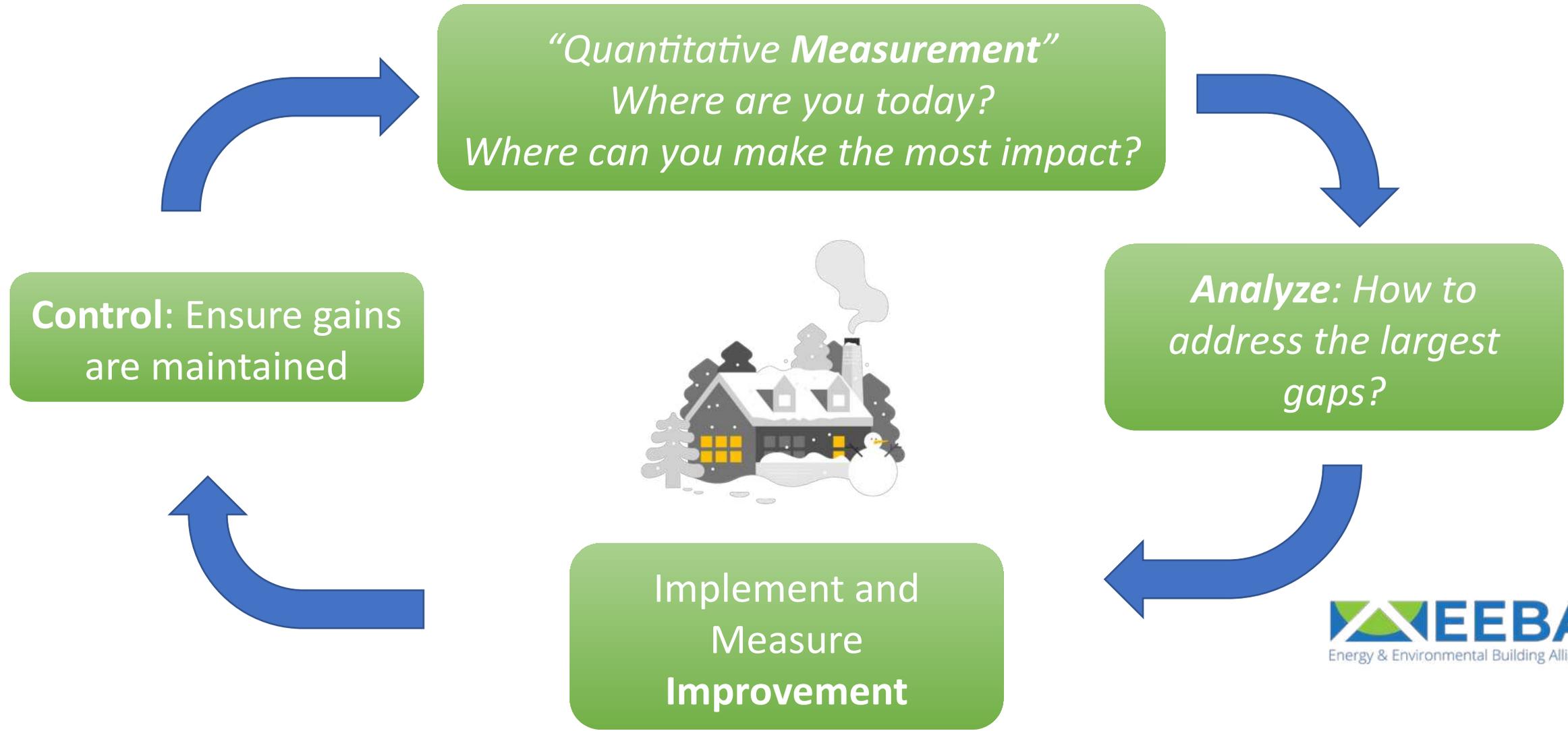
Windows Installed BEFORE DuPont™ Tyvek® WRB

Placement of Window Relative to Finished Wall	Placement of Tyvek® WRB vs. DuPont Exterior Continuous Insulation (CI)	Bump Out Frame Installed at Rough Opening	Installation Considerations
Windows Aligned with the exterior wall	WRB OVER CI	YES*	SEE Section 1
Windows Recessed from the exterior wall	WRB UNDER CI	NO	SEE Section 2

Windows Installed AFTER DuPont™ Tyvek® WRB

Placement of Window Relative to Finished Wall	Placement of Tyvek® WRB vs. DuPont Exterior Continuous Insulation (CI)	Bump Out Frame Installed at Rough Opening	Installation Considerations
Windows Aligned with the exterior wall	WRB OVER CI	YES*	SEE Section 3
Windows Recessed from the exterior wall	WRB UNDER CI	NO	SEE Section 4
Windows Aligned with the exterior wall	WRB UNDER CI	YES	SEE Section 5

Continuous Improvement Methodology



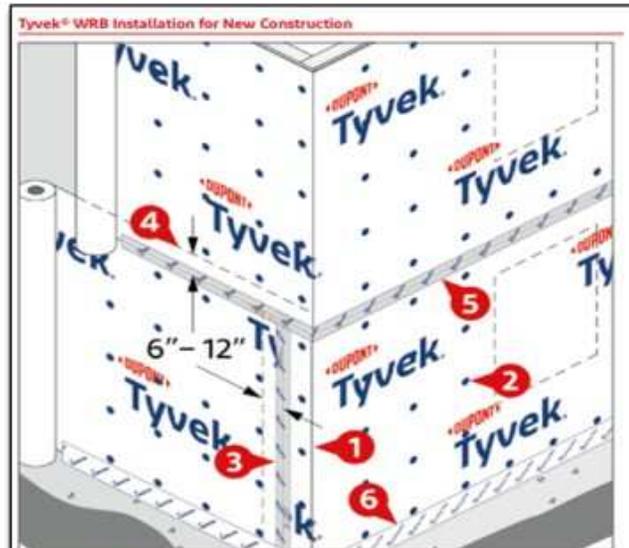
Implement

- Training – hands on for the first time
- Explain the Why
- Mock-ups
- Re-test your measurement after implementation
- Use product manufacturers!



Maintain the Gains

- Jobsite Observations "Trust but verify"
- Train on the "Why"
- Don't be discouraged by setbacks



1. Tyvek® WRB roll aligned at bottom corner of structure and unrolled starting at corner and directly over window/door rough openings. All vertical seams overlapped by 6"-12".
2. Tyvek® WRB secured to stud or nail-base material with recommended fasteners spaced 6"-18" on vertical stud lines. No fasteners within 6" of sills and jams and 9" of the head of window/door rough openings.
3. Vertical seams of Tyvek® WRB taped with DuPont™ Tyvek® Tape.
4. Upper layer of Tyvek® WRB installed overlapping bottom layer by min. 6".
5. **Air Barrier Installations:** All horizontal seams taped. (3" Tyvek® Tape required on horizontal and vertical seams when using DuPont™ Tyvek® StuccoWrap®, Tyvek® DrainWrap™ or Tyvek® CommercialWrap® D).
6. **Air Barrier Installations:** All terminations of the Tyvek® WRB (including, but not limited to, top-of-wall/bottom-of-wall interfaces) taped or sealed with Tyvek® Tape or DuPont Self-Adhered Flashing Products.

- Recommended Fasteners (non-exhaustive list):**
- DuPont™ Tyvek® Wrap Cap Nails, Screws, or Staples
 - Other cap staples for Stinger® Cap Stapler
 - TRUFAST® Walls Grip-Deck® screws with Thermal-Grip FastCap™ washers (TRUFAST® Walls formerly Rodenhouse).

DuPont Building Envelope Solutions **DU PONT**

Styrofoam™ Brand XPS Insulation
Field Observation Report

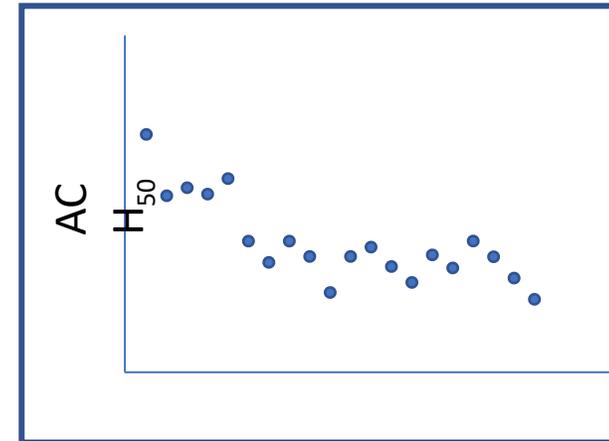
This report is used to monitor the installation of DuPont Exterior Continuous Insulation Products in Single-Family Residential building applications.

Project Information			Builder/General Contractor Name		
Project Name			Company		
Address			Address		
City	State	Zip Code	City	State	Zip Code
Observation Date	Observation	UF	Phone		
Installing Contractor Name			DuPont Building Envelope Specialist		
Company			Name		
Address			Address		
City	State	Zip Code	City	State	Zip Code
Email			Phone		

Building Information

NOTE: Completion of this section is only required if DuPont Exterior Continuous Insulation Products are serving as the WRB.

Number of stories	Building height				
Water testing <input type="checkbox"/> yes <input type="checkbox"/> no	Pressure tested (where applicable)				
Interior facade <input type="checkbox"/> vinyl <input type="checkbox"/> cedar <input type="checkbox"/> brick <input type="checkbox"/> metal panel <input type="checkbox"/> other	<input type="checkbox"/> flat concrete	<input type="checkbox"/> cultured stone			
Rainscreen <input type="checkbox"/> yes <input type="checkbox"/> no					
Window type <input type="checkbox"/> integral flanged <input type="checkbox"/> non-integral flanged <input type="checkbox"/> brick mold <input type="checkbox"/> field applied flanged <input type="checkbox"/> non-flanged <input type="checkbox"/> other					
Window condition <input type="checkbox"/> concrete finish mount <input type="checkbox"/> precast recessed <input type="checkbox"/> stucco <input type="checkbox"/> other					
Door type <input type="checkbox"/> integral flanged <input type="checkbox"/> non-integral flanged <input type="checkbox"/> field applied flanged <input type="checkbox"/> brick mold <input type="checkbox"/> other					
Stud spacing	Select stud spacing				
Type of sheathing	Select sheathing type				
Has code-approved wall bracing been provided in lieu of exterior wood sheathing? <input type="checkbox"/> yes <input type="checkbox"/> no					
Type of exterior insulation					
Select exterior insulation type					
Select exterior insulation method					
Which DuPont product is serving as the WRB? Select DuPont product					
<small>NOTE: If a DuPont™ Tyvek® product is serving as the WRB, also complete the DuPont Building Envelope Solutions Field Observation Report.</small>					



Time



Addison Homes



The Journey Begins

- 2004
- New builder searching for homebuilding "Best Practices"
- South Carolina Earthcraft House Builder Training
- Ah-Ha! Moment – Successfully Sustainable!
- First Custom Home client - "try" Earthcraft?



The Journey Begins



The Journey Begins



The Journey Begins



Congratulations!



Your home is an
EarthCraft House™

It's been inspected for energy efficiency,
water and waste reduction, and
improved indoor air quality

For more information visit www.EarthCraftHouse.com

*A partnership between the Greater Atlanta Home Builders Association
& Southface Energy Institute.*



The Journey Begins

- \$273,000
- 4,400 Sq Ft
- 13% Gross Margin
- HERS 88
- Better than code!



The Journey Begins

- Challenges

2007 - Model Home



2007 - Exterior Insulation First Try

- R-3 Exterior Insulation
- No taped seams
- Framer Cost
- Builders Laughed

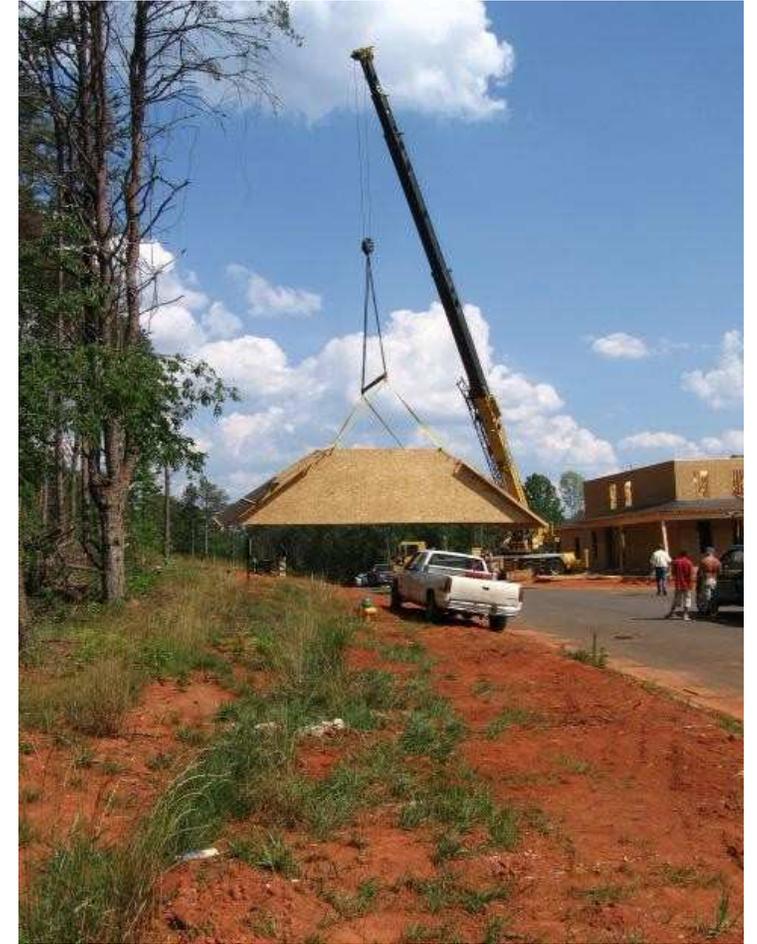


Lessons - 2007

- Encapsulated crawlspace (too small for HVAC)



Roof Trusses – Wrong Pitch



Renovation 2009 - Exterior Insulation!



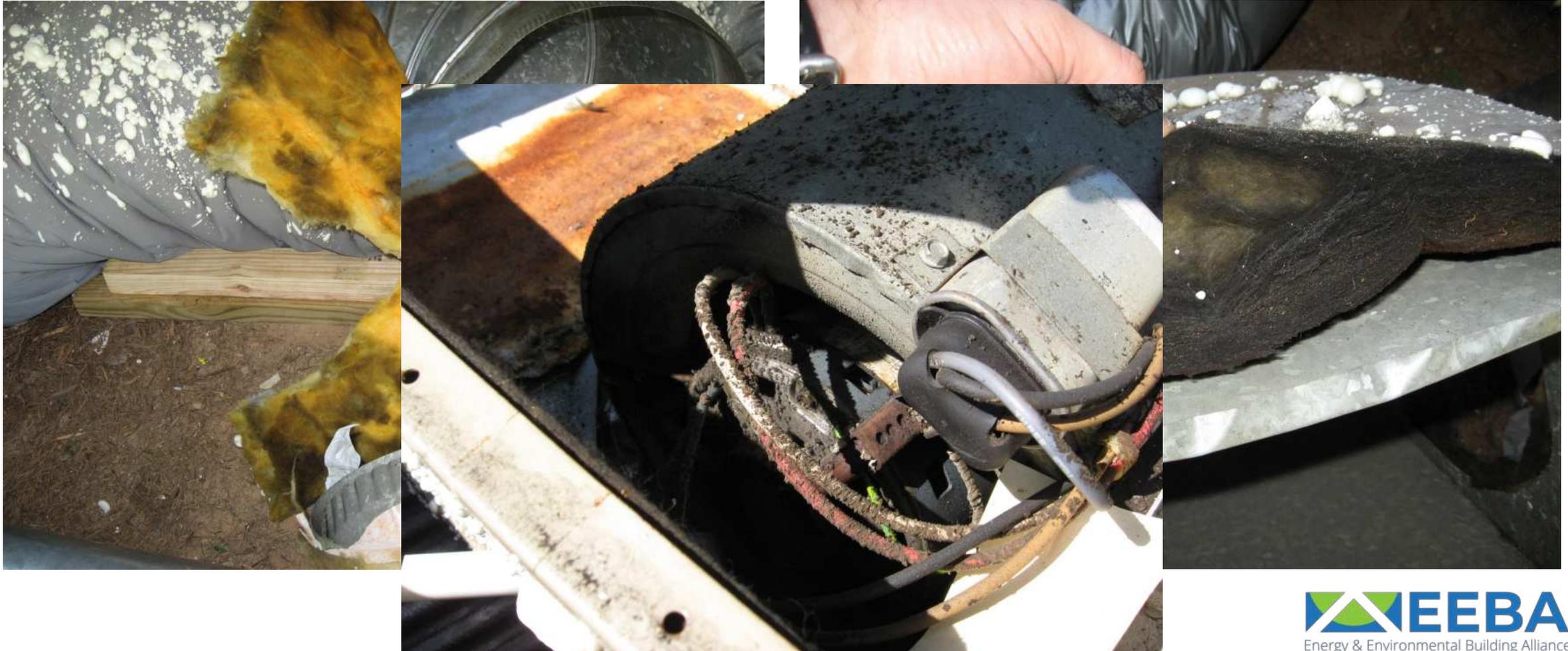
Renovation 2009 - Air Sealing



Renovation 2009 – Duct Sealing



Renovation 2009 – Duct Sealing



Renovation 2009 – Air Sealing



Next step - 2011

- Integrated WRB



Next step - 2011

- Blown-in wall insulation



2015 – Model Home



2015 – Model Home

- Back to Exterior Insulation



2015 - Model Home

- Advanced Framing



2015 – Model Home

- Solar Shingles



2016 – Ducts in Conditioned Space



2016 – Ducts in Conditioned Space



DOE Net Zero Ready

- First Home < 1 ACH₅₀



DOE Net Zero Ready

- RHEIA Ducts in Conditioned space

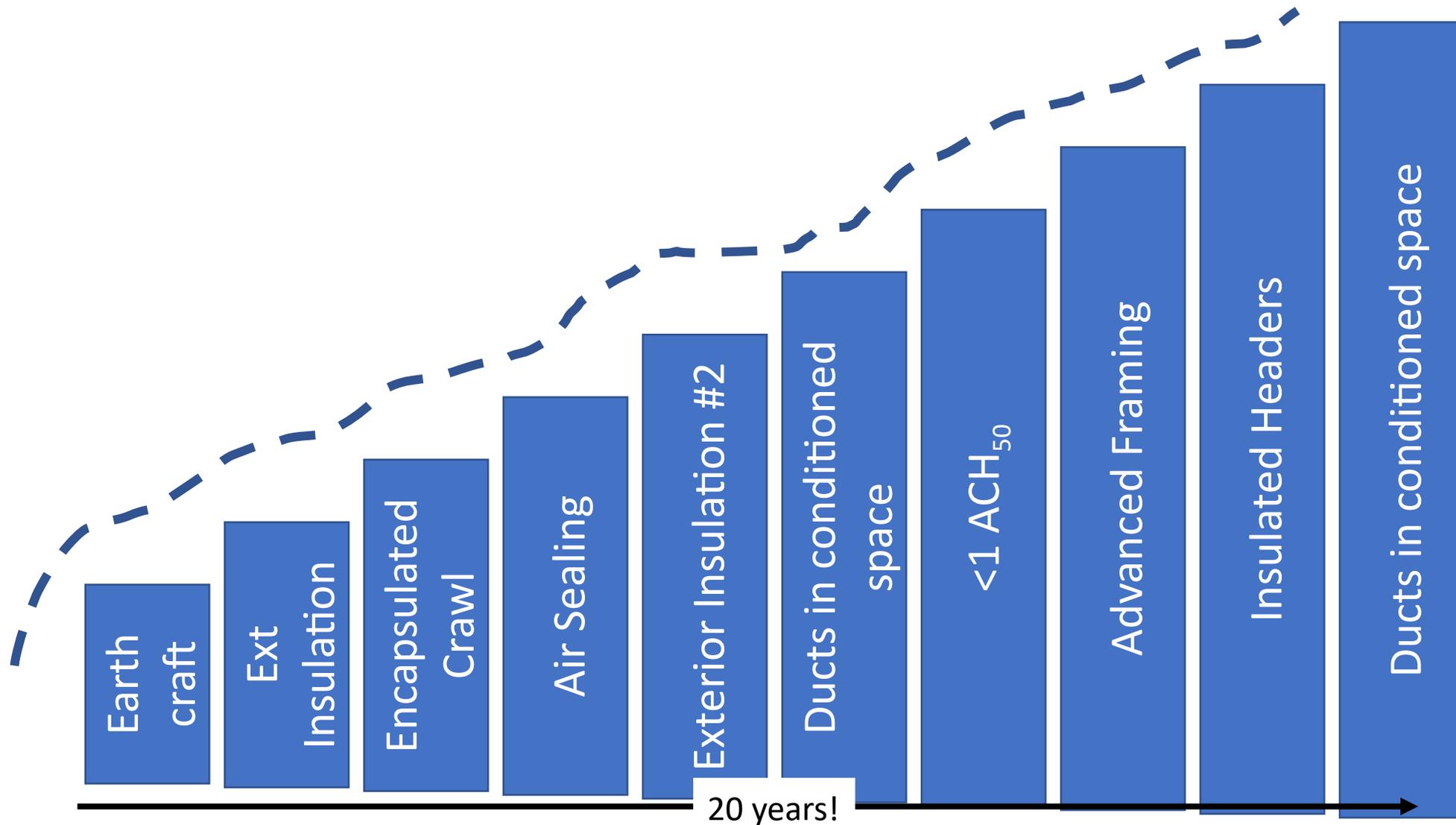


DOE Net Zero Ready

- Advanced Framing
- 2x6, 24" O.C.
- R-6 Exterior Insulation
- R-19 Cavity Insulation
- Insulated Headers



Real Life Stepwise Growth vs. Giant Leap



Moving Forward

- Predictable air tightness
- New air sealing strategies
- Replicability
- Focus on Trade communication / Visual scopes of work
- Make it easy for our Trade Partners

Wrap-up

- Progress is not linear!
- Lots of learning experiences
- Have to keep driving for efficiencies in the face of obstacles
- Leverage to make it easier for yourself – many resources!
 - Education + training
 - Manufacturers
 - Peers



THANK YOU!