

# Health Wellness & High-Performance Solutions

Karla Butterfield, Sustainability Director



**Steven Winter Associates, Inc.**  
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Our services include:

- Energy Conservation and Management
  - Decarbonization
  - Sustainability Consulting
  - Green Building Certification
  - Accessibility Consulting
- 

Our teams are based across four office locations:  
New York, NY | Washington, DC | Norwalk, CT | Boston, MA

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# Session Objectives

- Identify health and wellness trends
- Analyze building science solutions to increase health and wellness
- Explore how energy and water strategies can be applied to improve indoor environments
- Identify healthy home products, systems and technologies on the market today
- Determine best strategies to optimize occupant health and well-being



# ROADMAP

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**1** Consumer Insights

**2** Business Case

**3** The Details: How to make it happen

Building Best Practices

Cost & Code

ESG & Embodied Carbon

Marketing

Use & Post-Sale



# CONSUMER INSIGHT DATA

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Source: New Home Trends Institute

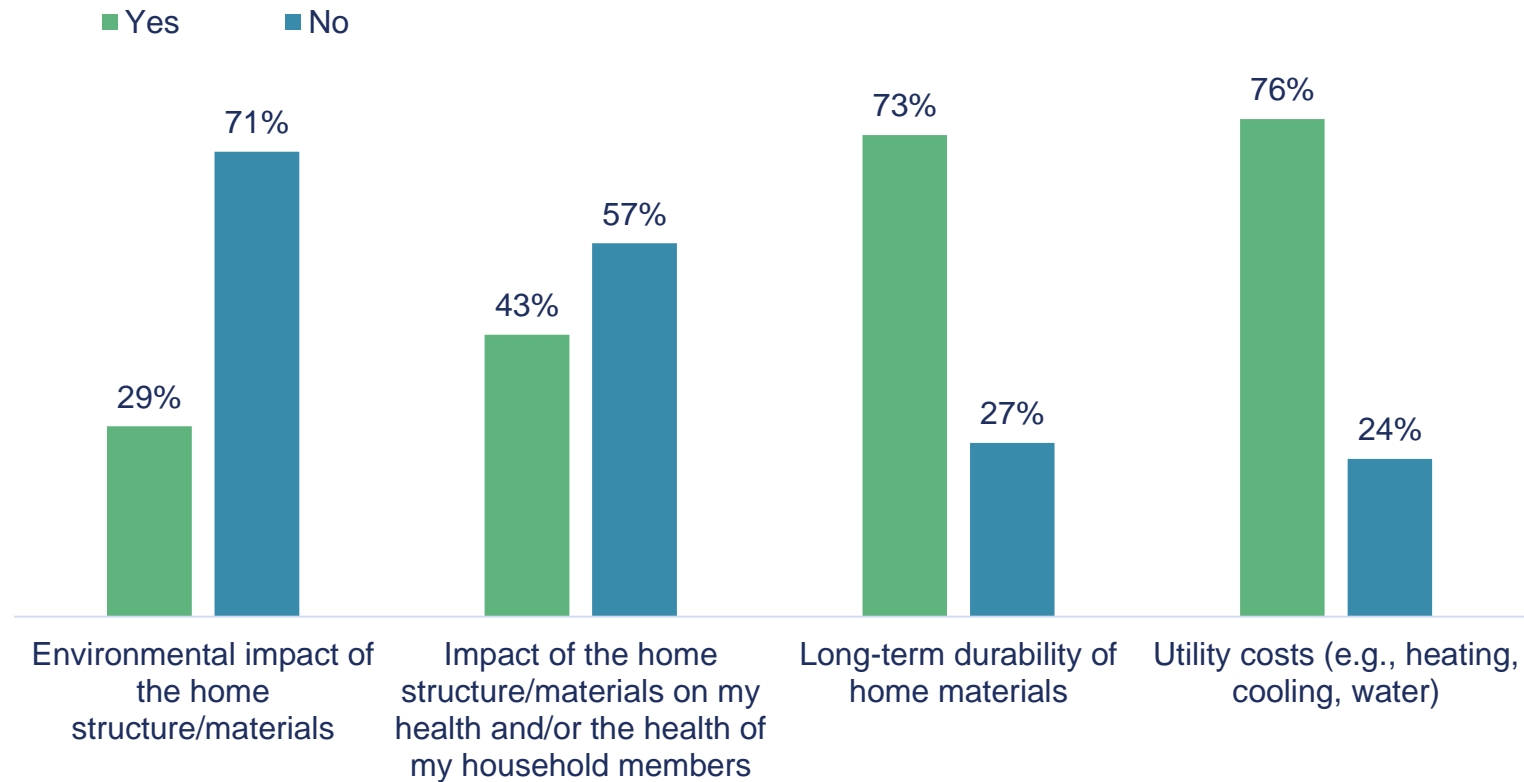
- John Burns Real Estate Consulting, LLC
- November 2022 survey, published January 2023
- 1,263 homeowners and single-family renters
- Age 18+
- Household income of \$50,000+

# DECISION MAKING FACTORS FOR CURRENT HOME VS. FUTURE HOME



## Factors that influenced current home selection decision

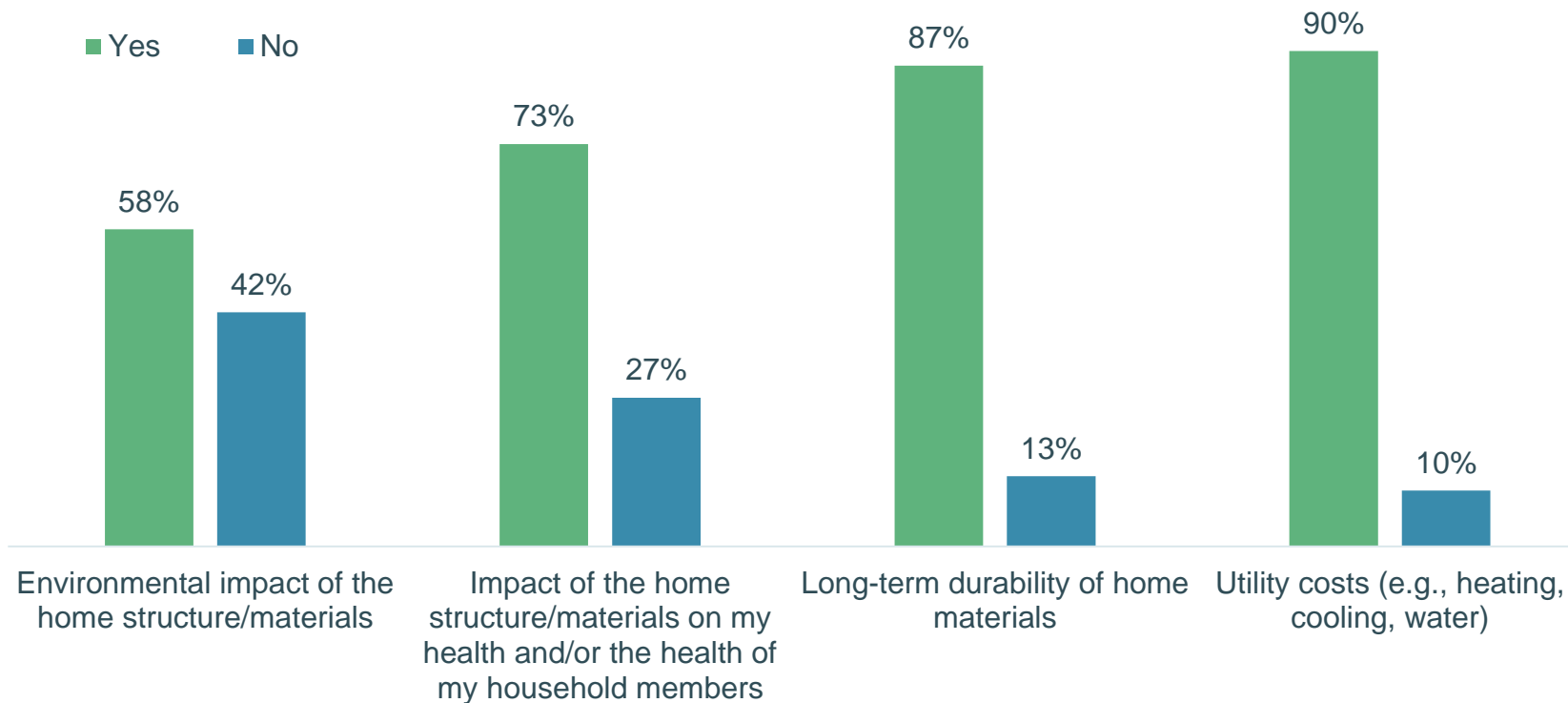
Share of homeowners and single-family renters with household income of \$50,000+



# DECISION MAKING FACTORS FOR CURRENT HOME VS. FUTURE HOME



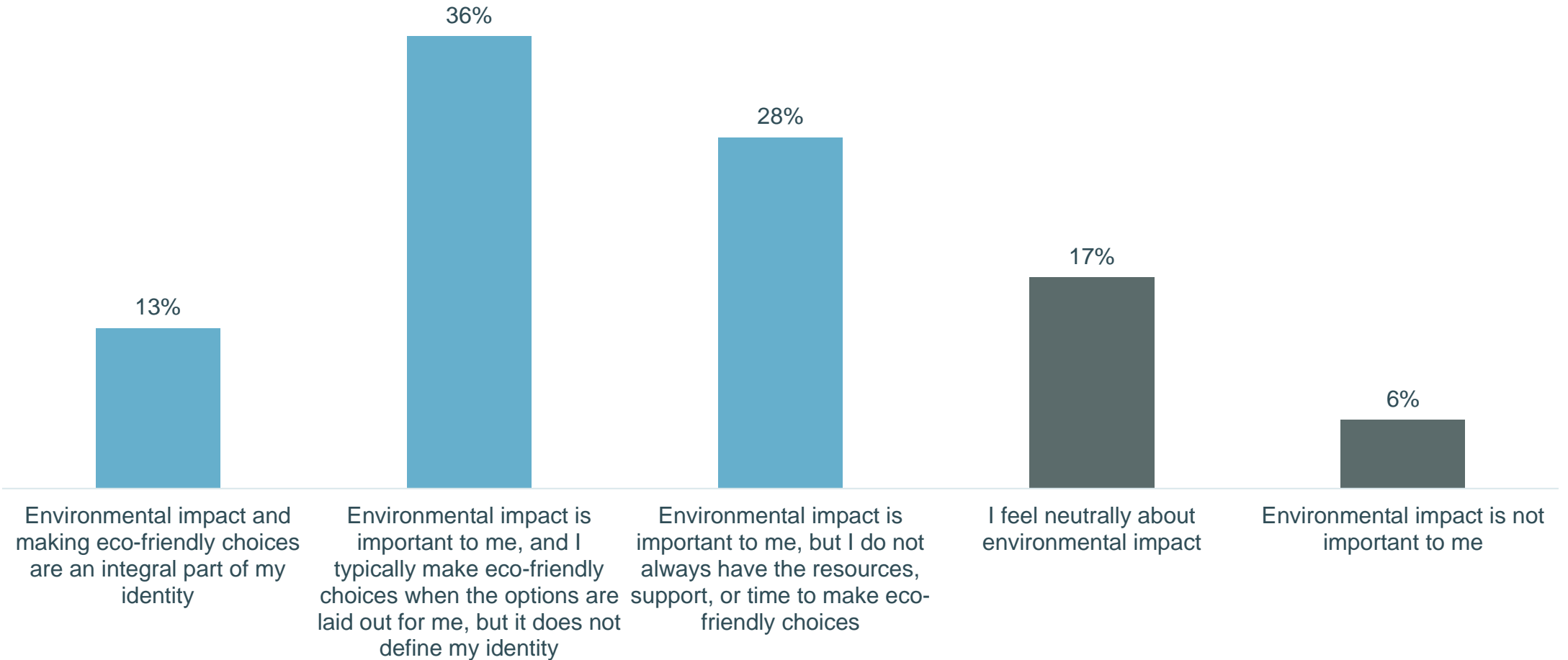
## Factors that would influence next home selection decision





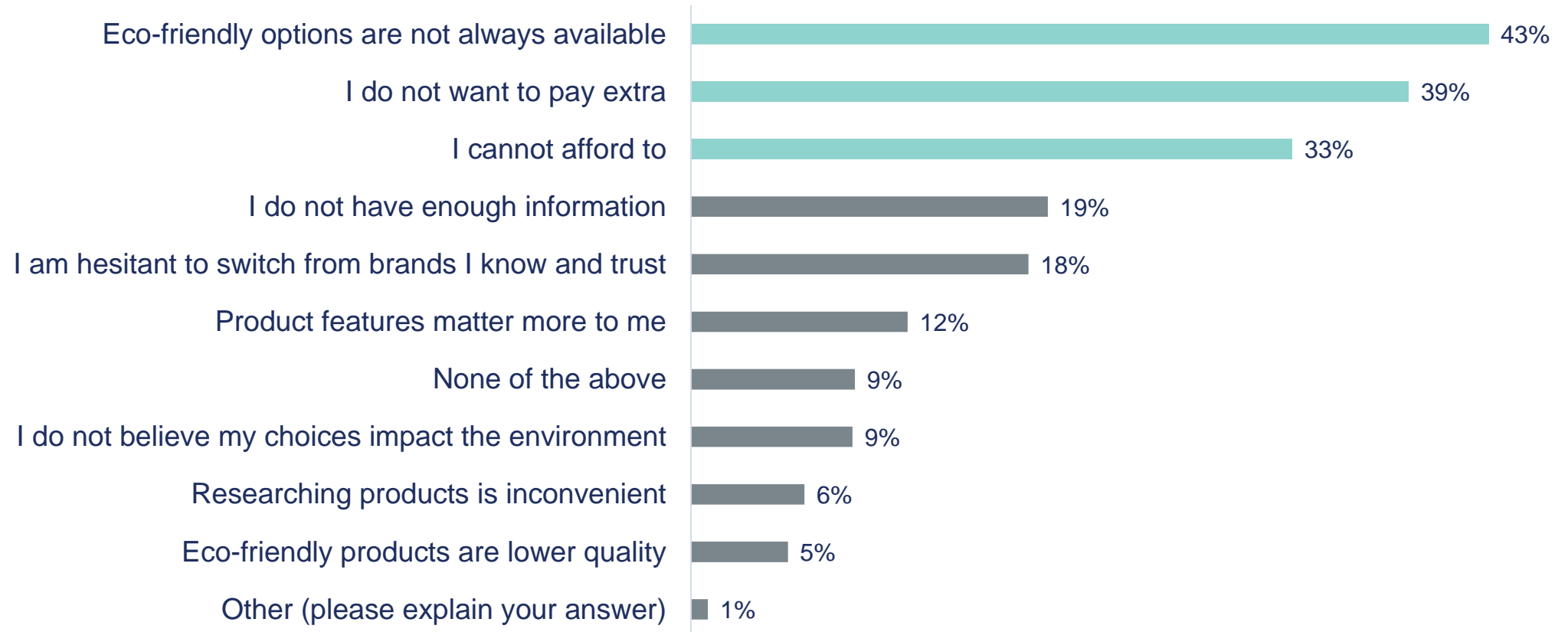


## Degree to which environmental impact is a consideration in your life



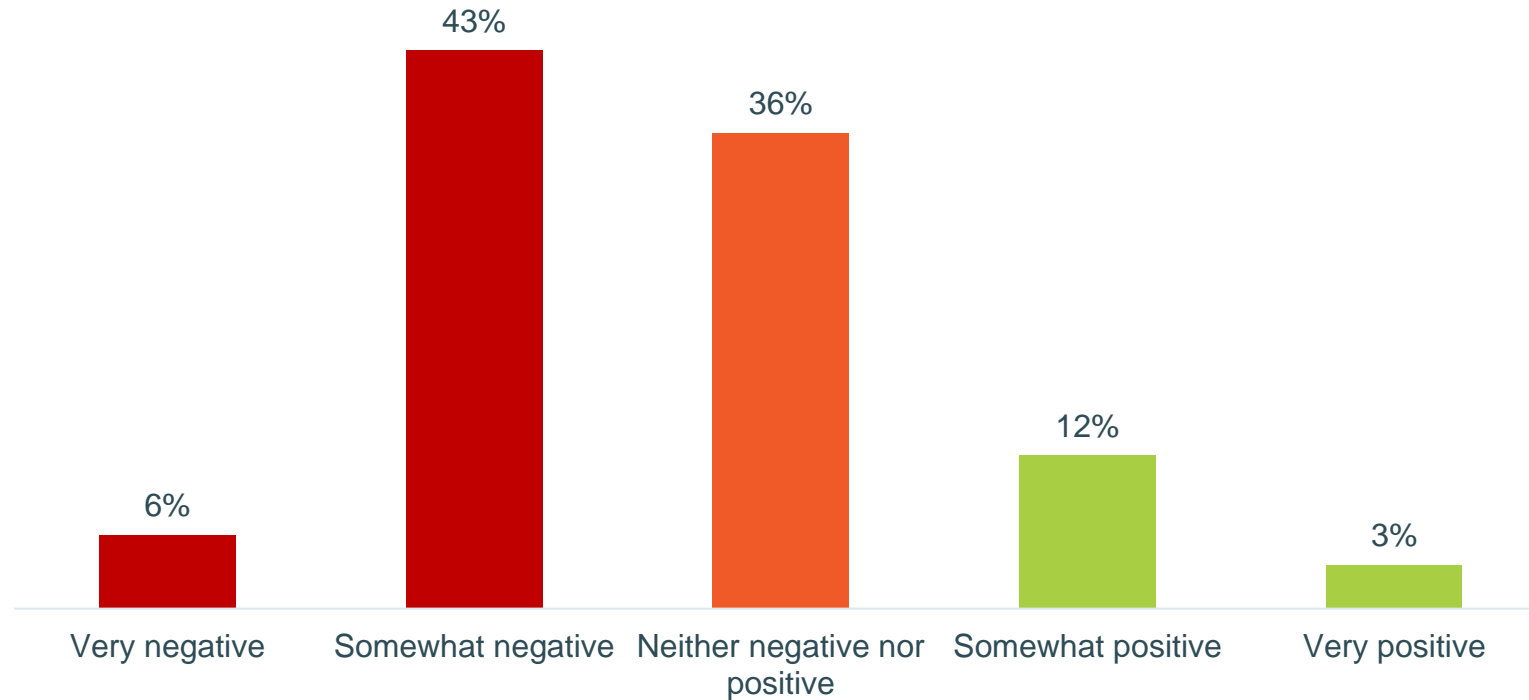


## Circumstances preventing consumers from making eco-friendly choices



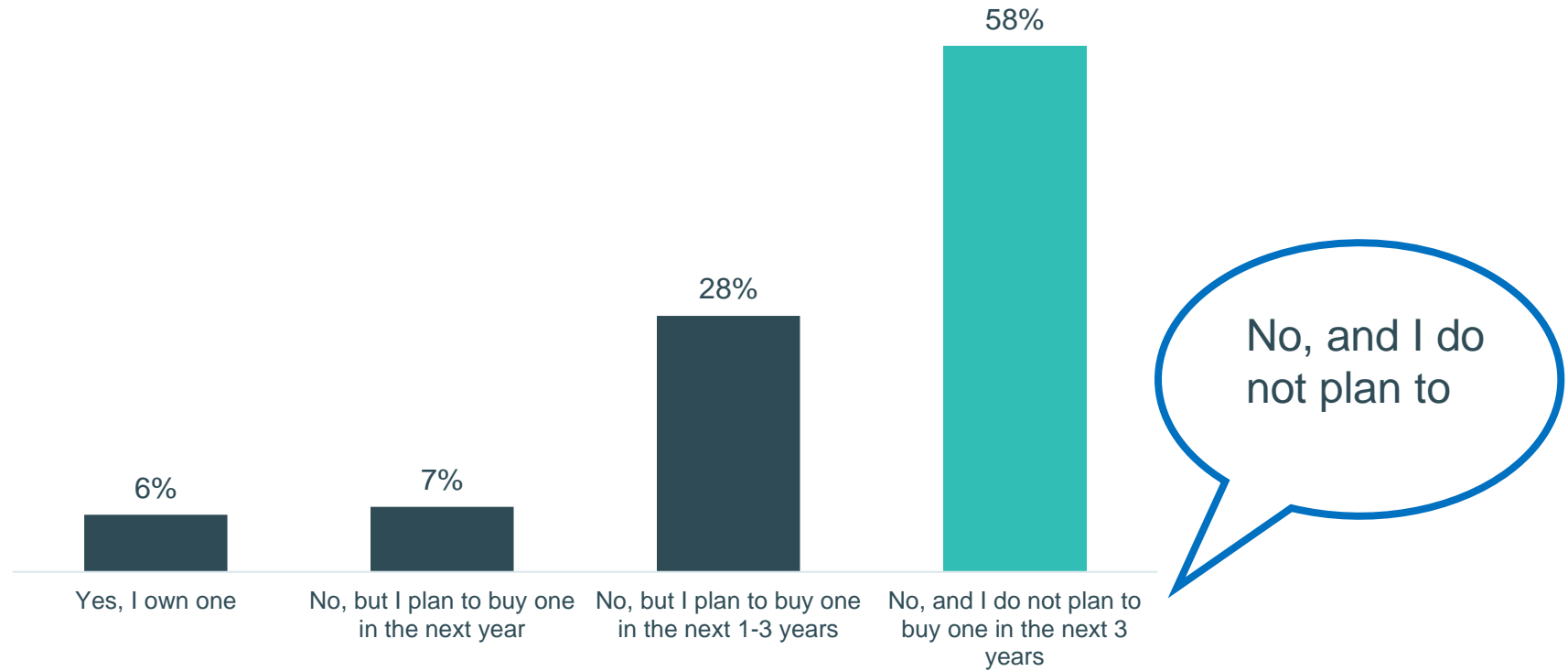


## What is the impact of the homebuilding Industry's on the environment?



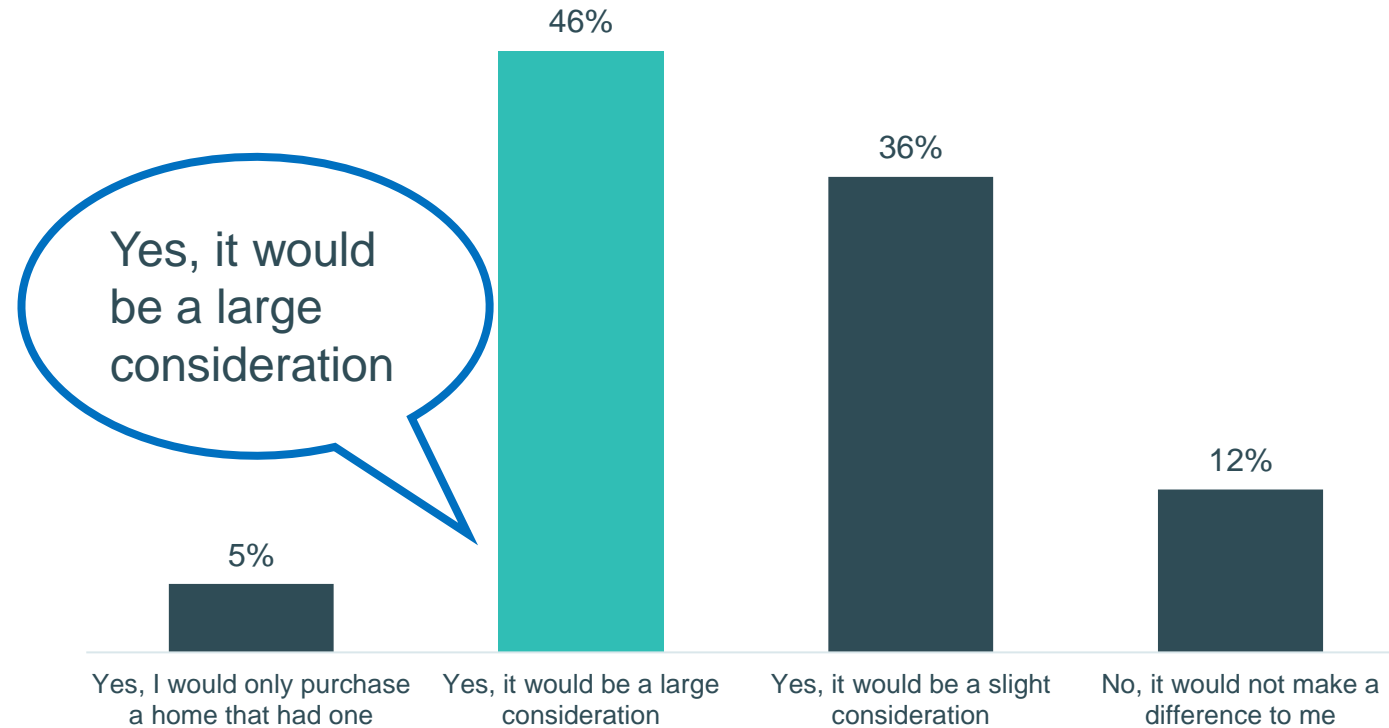


## Have or plan to buy a plug-in hybrid or all-electric vehicle



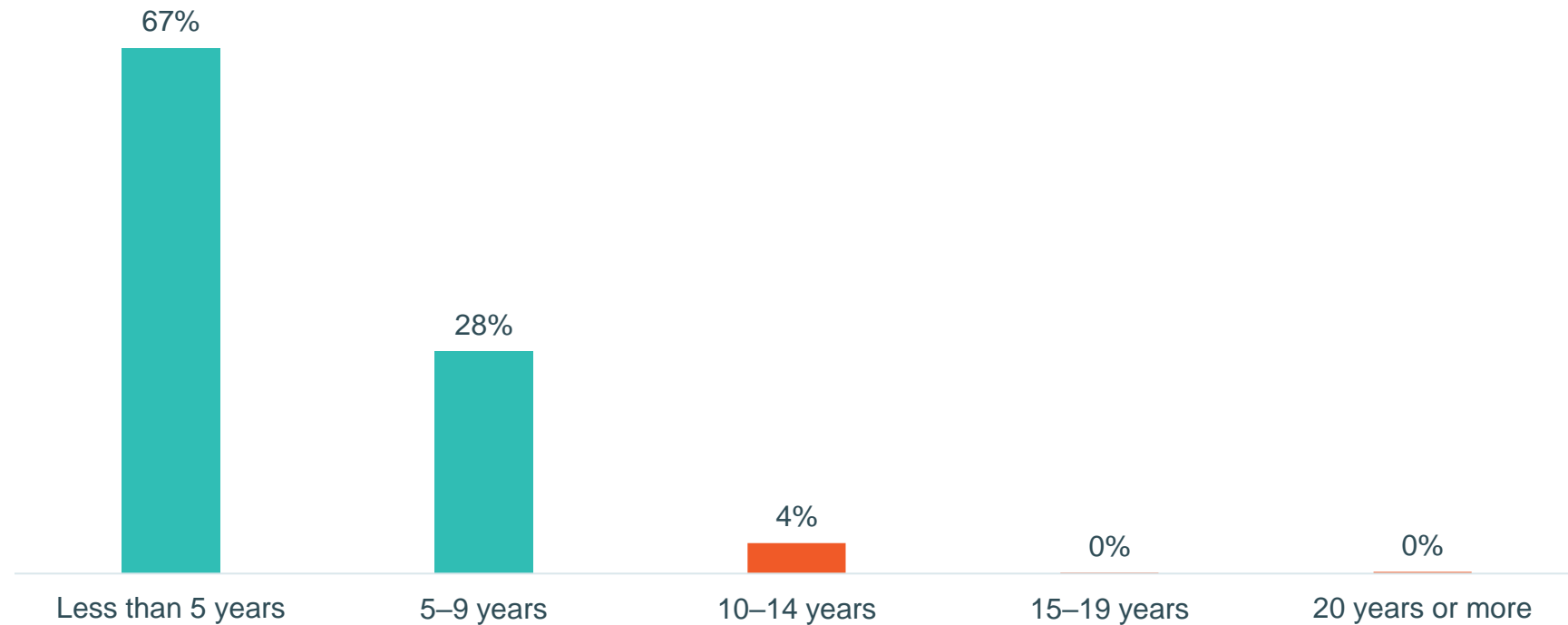


## Likelihood of purchasing a home if it came with an EV charging station



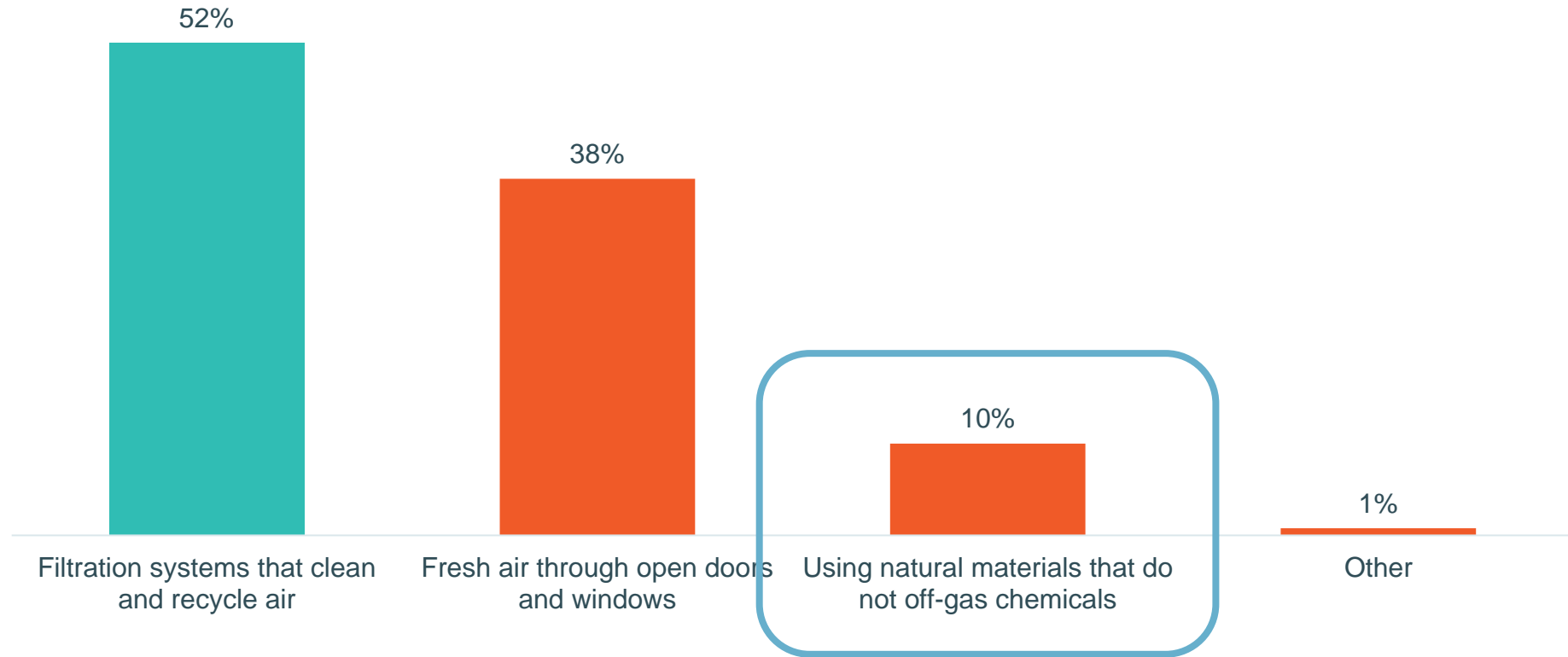


## Acceptable pay-back period for solar panels





## Best way to get healthier indoor air





## Baseline Indoor Air Quality Field Study in Occupied New U.S. Homes: Cold and Marine Climate Zones



Pacific Northwest National Laboratory  
Cheryn Metzger/Jian Zhang, Senior Research Engineers  
(707) 623-7091, [Cheryn.Metzger@pnnl.gov](mailto:Cheryn.Metzger@pnnl.gov)

Images from [epa.gov](http://epa.gov) and [medlineplus.gov](http://medlineplus.gov)

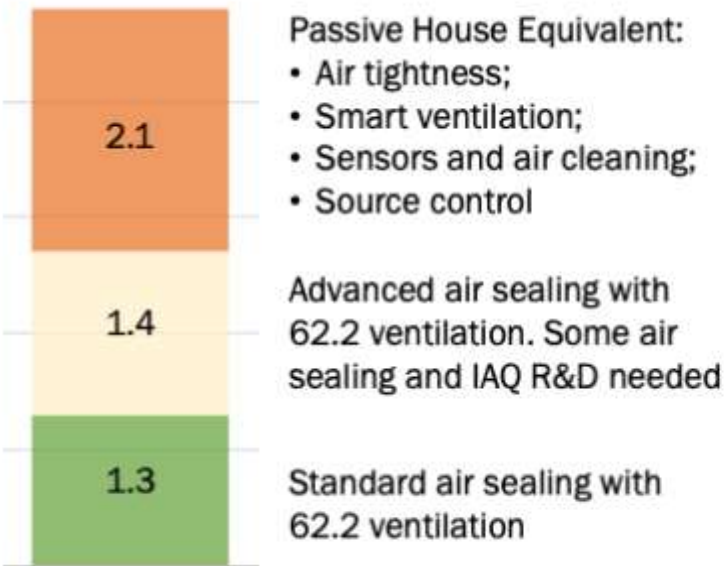


# Impact



## Tighter US homes will use 3 Quads less source energy per year<sup>1</sup>

Source Energy Savings (Quads)



Passive House Equivalent:

- Air tightness;
- Smart ventilation;
- Sensors and air cleaning;
- Source control

Advanced air sealing with 62.2 ventilation. Some air sealing and IAQ R&D needed

Standard air sealing with 62.2 ventilation

[IAQ Study PNNL](#)

## California study found acceptable IAQ in newish homes with MV

Mean indoor concentration	CA homes pre-MV	CA homes with MV
Formaldehyde	36.3 ppb	19.8 ppb
PM <sub>2.5</sub>	13.3 µg/m <sup>3</sup>	8.3 µg/m <sup>3</sup>
NO <sub>2</sub>	5.4 ppb	6.1 ppb

Since 2012, IECC requires dwelling unit mechanical ventilation (DUMV).

Kitchen exhaust still not required.

Some states requiring DUMV only for tightest homes, e.g. <3 ACH50.

Field data will inform future revisions to industry standards.



On July 27, the Environmental Protection Agency (EPA) signed a long-overdue final rule to protect people from formaldehyde off-gassing from composite wood products such as hardwood plywood, medium-density fiberboard, and particleboard. *UPDATE: EPA published the final rule on December 12, 2016.*

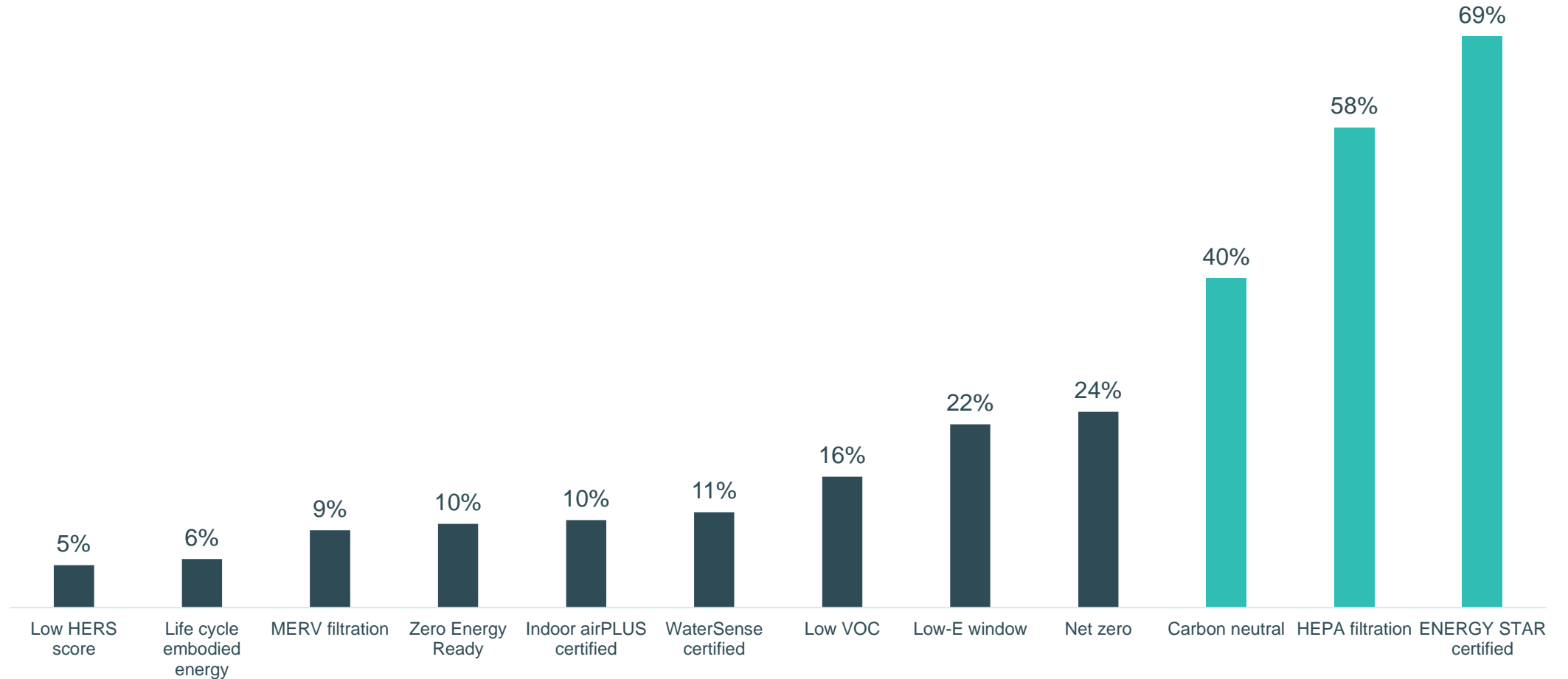
These products are commonly used to make furniture, cabinets, and flooring. Title VI of the Toxic Substances Control Act (TSCA) directed EPA to issue the rule and base it on the 2007 standards set by the California Air Resources Board (CARB) with a significant exception; EPA closed a loophole in CARB's standards by extending them to cover laminated hardwood products. Such laminated products were the focus of the Lumber Liquidators controversy in 2014.

Acceptable levels for CA **newish** homes

# Consumer Insights Data

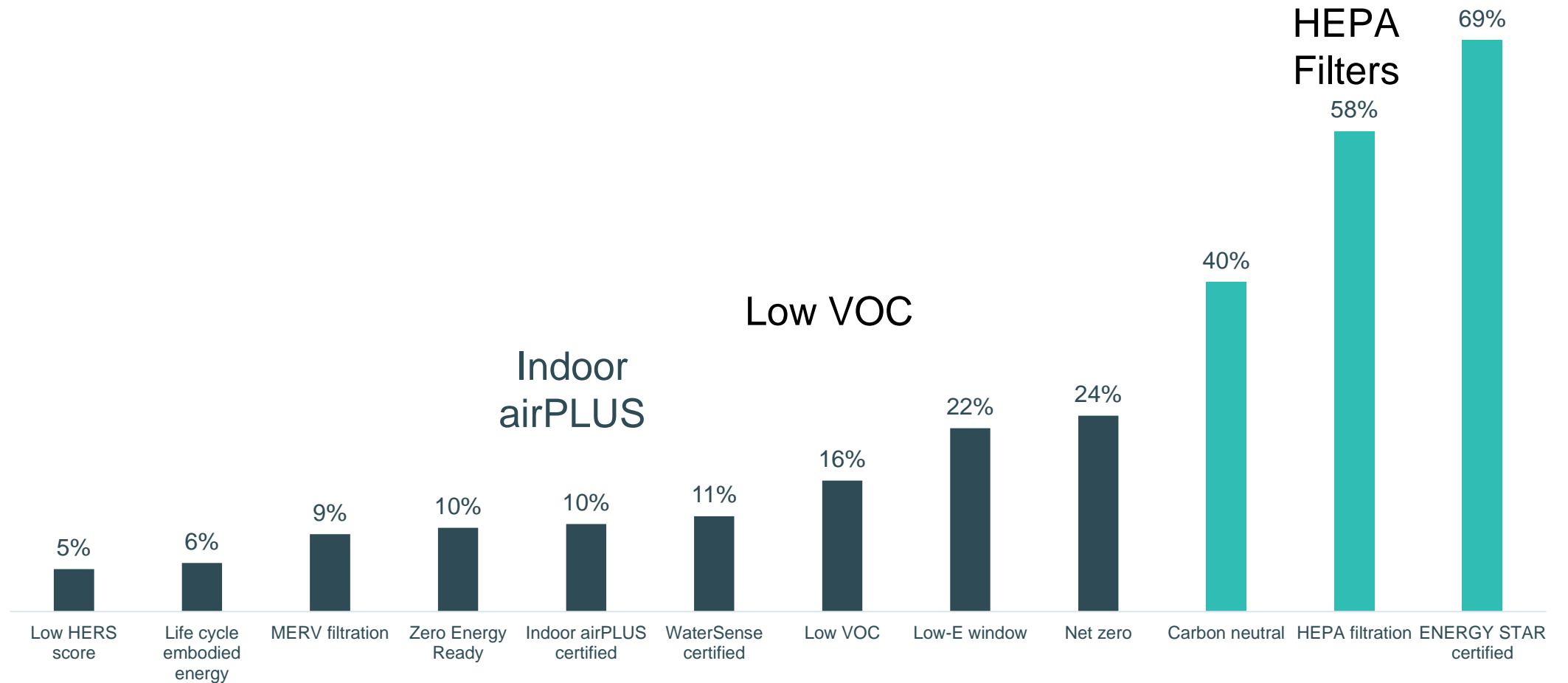


## Knowledge rating – I am familiar with these terms





## Knowledge rating – I am familiar with these terms





# CONSUMERS: A HEALTH EVOLUTION

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- 2000 Consumer Health Trends
- 2008 Indoor airPLUS
- 2015 WELL Building Standard
- 2019 COVID
- 2020 Awareness
  - IAQ
  - Physical/Mental well being
  - Health monitoring devices

## Case Study New Construction



- 2020 AWARENESS  
IAQ  
Physical/Mental well being  
Health monitoring devices
- Award Winning Builder RESPONDS  
Thrive Home Builders, founded 1992 ~ Denver  
RESNET most efficient builder in North America  
ProBuilder Magazine builder of the year





# Green



- Builder of the Year, *Green Home Builder Magazine*
- Best in Green, *International Builders Show*
- Green Home of the Year, *Green Builder Magazine*
- LEED Partner of the Year





# Resilient

- Air-tight construction
- Fire resistant siding
- Fire rated roofing



The Marshall Fire, Dec. 30, 2021.  
Thrive homes are in the foreground. None were lost.

WHAT SHE'S

# Breathing

IS JUST AS IMPORTANT

AS WHAT YOU'RE FEEDING HER.



## Healthy

US Environmental Protection Agency Indoor airPLUS Builder of the Year

EPA Indoor airPLUS Leader Award, 2016-2022

International Builders Show, Best in American Living Platinum for Healthy Home, 2021



# Designed and Constructed During the Pandemic

- Separated outdoor living
- Work and learn from home
- Exercise and Play at home
- Net Zero Energy —All electric
- Battery backup
- DOE Zero Energy Ready
- EPA Indoor airPLUS — Focus on health
- Energy Star
- LEED Platinum







# Outdoor Living



Outdoor delivery closet

Outdoor seating separated from sidewalk and entry



Private outdoor seating on back patio

- Multiple outdoor living areas provide opportunities for gathering while maintaining social distance
- Separate outdoor Amazon delivery closet makes deliveries both safe and secure

# Work and Learn from Home



- Main floor study provides private space for work or study



- Basement study space provides for separate learning from home.





# Exercise and Play at Home



- Upstairs loft offers a light-filled exercise space
- Basement recreation room provides a separate space for fun and games with sound separation from other living areas



# Designed for Health



## ALL ELECTRIC APPLIANCES AND FIREPLACE

- Energy Star appliances
- Induction cooking
- All electric  
no combustion gases in  
the home



# Designed for Health



- “Clean Room” mechanical room
- Heat pump hot water heater
- Air source heat pump for heating/cooling
- Whole house HEPA filtration
- Activated carbon MERV 13 filtration
- ERV

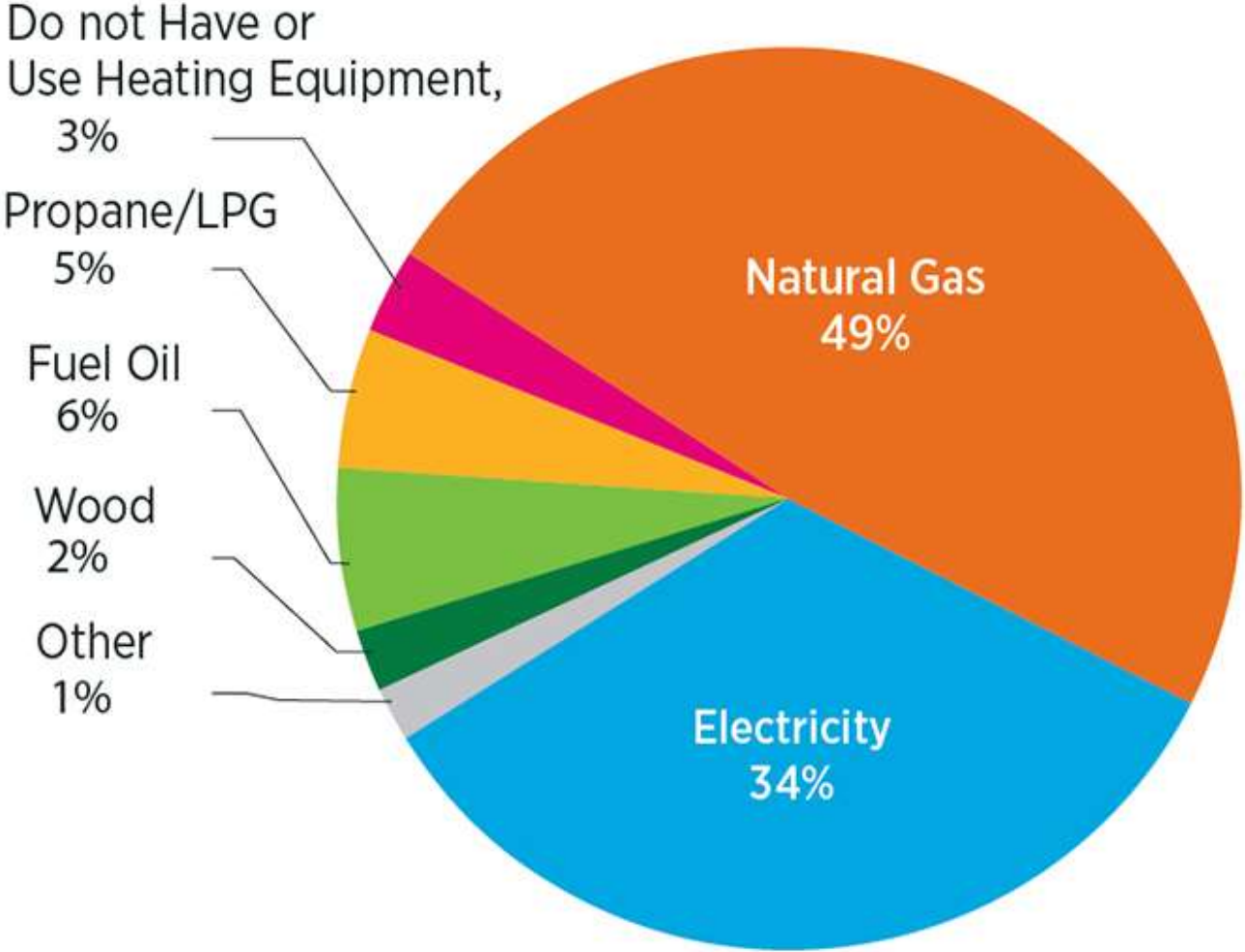
# First Cost



Description	Electric	Gas
Central Heating/Cooling	\$21,211	\$12,939
Hot Water	3,750	1,900
Electric Modification	350	--
Gas Main	--	160
Gas Lateral	--	625
Gas Piping	--	1,000
<b>Total Cost</b>	<b>\$25,311</b>	<b>\$16,624</b>
Xcel Rebate	(6,700)	(2,550)
Xcel Appliance Rebates	(955)	(155)
<b>Total</b>	<b>\$17,656</b>	<b>\$13,919</b>

**Difference before OH and Profit with Rebates**      **\$3,737**      **22.5% more**  
**Difference before OH and Profit without Rebates**      **\$8,687**      **52.3% more**

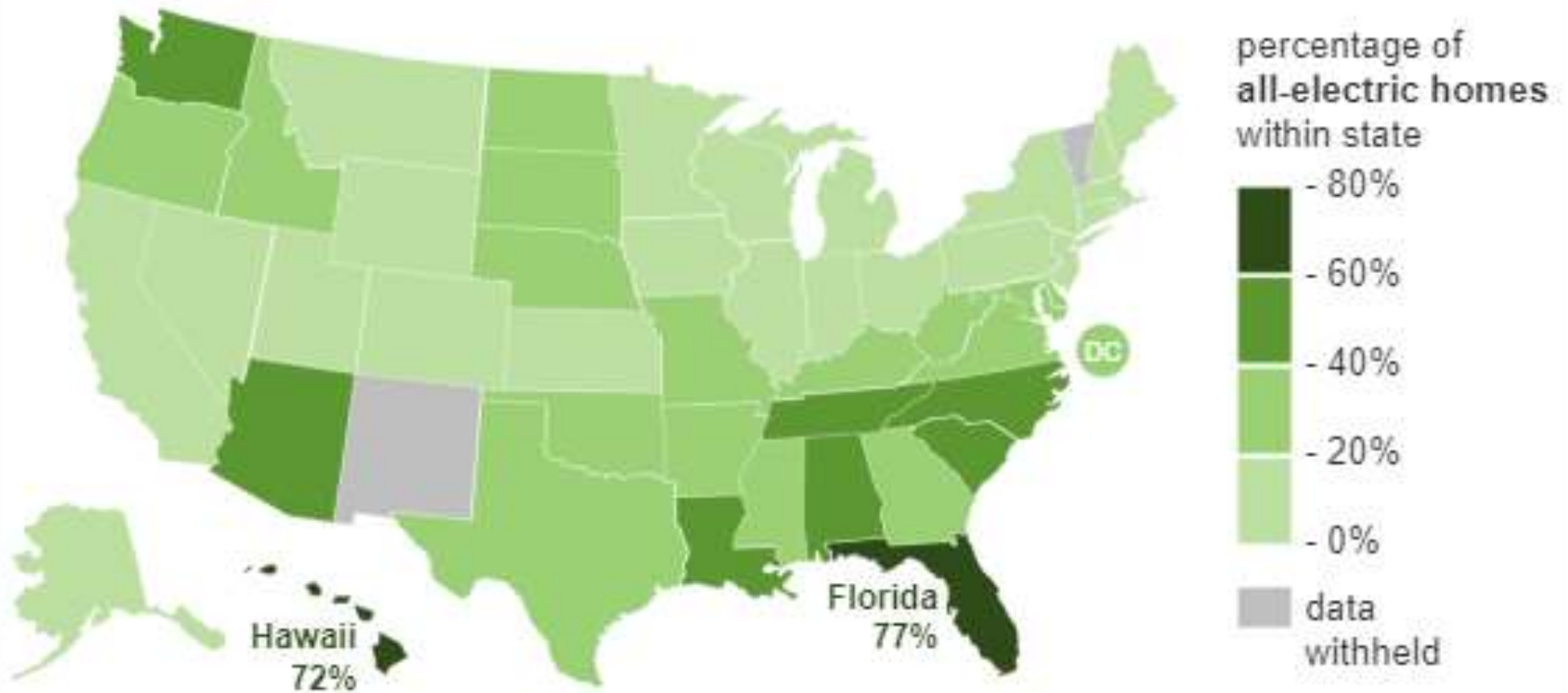
# Heating Fuels



# Electricity as the only source of fuel



All-electric homes by state (2020)

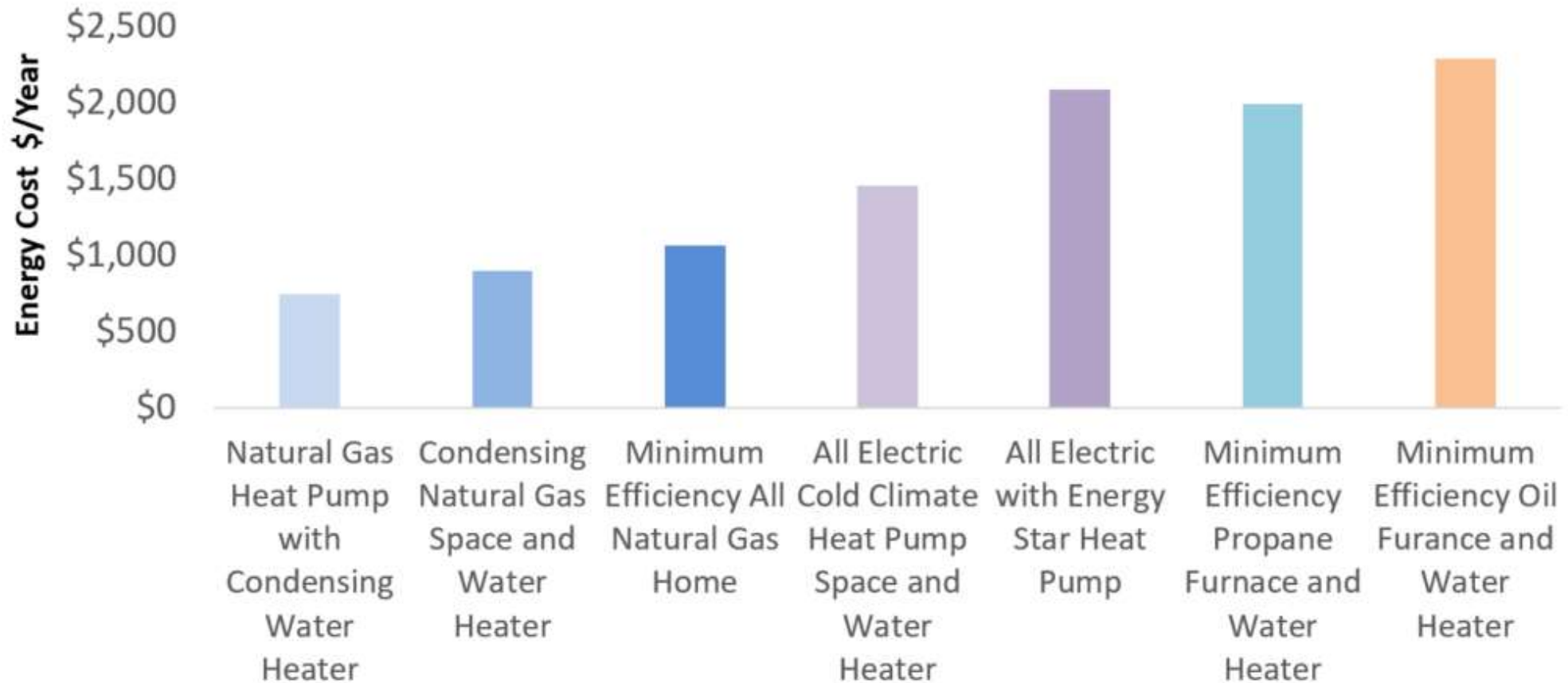


- ~25%
- Infrastructure dependent
- Climate matters

# Operating costs



Cost Comparison of Home Energy Use  
(Average Annual Energy Costs)





# Electrification and Carbon Reduction



What:

- Remove fossil fuels (the gas line connection) and power the home with all electricity. That means that the home itself will inherently produce less emissions

Why:

- Burning fossil fuels increases carbon emissions and reduces air quality in the home
- As the electric grid shifts to renewable sources, the carbon emissions from all homes on the grid will reduce
- If onsite solar is installed, that speeds up the timeline for carbon reduction



# The Details: How to Make it Happen

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- Code
- Building Best Practices
- ESG & Embodied Carbon
- Marketing
- Use & Post-Sale





# The Details: How to Make it Happen

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## Code

Building Best Practices

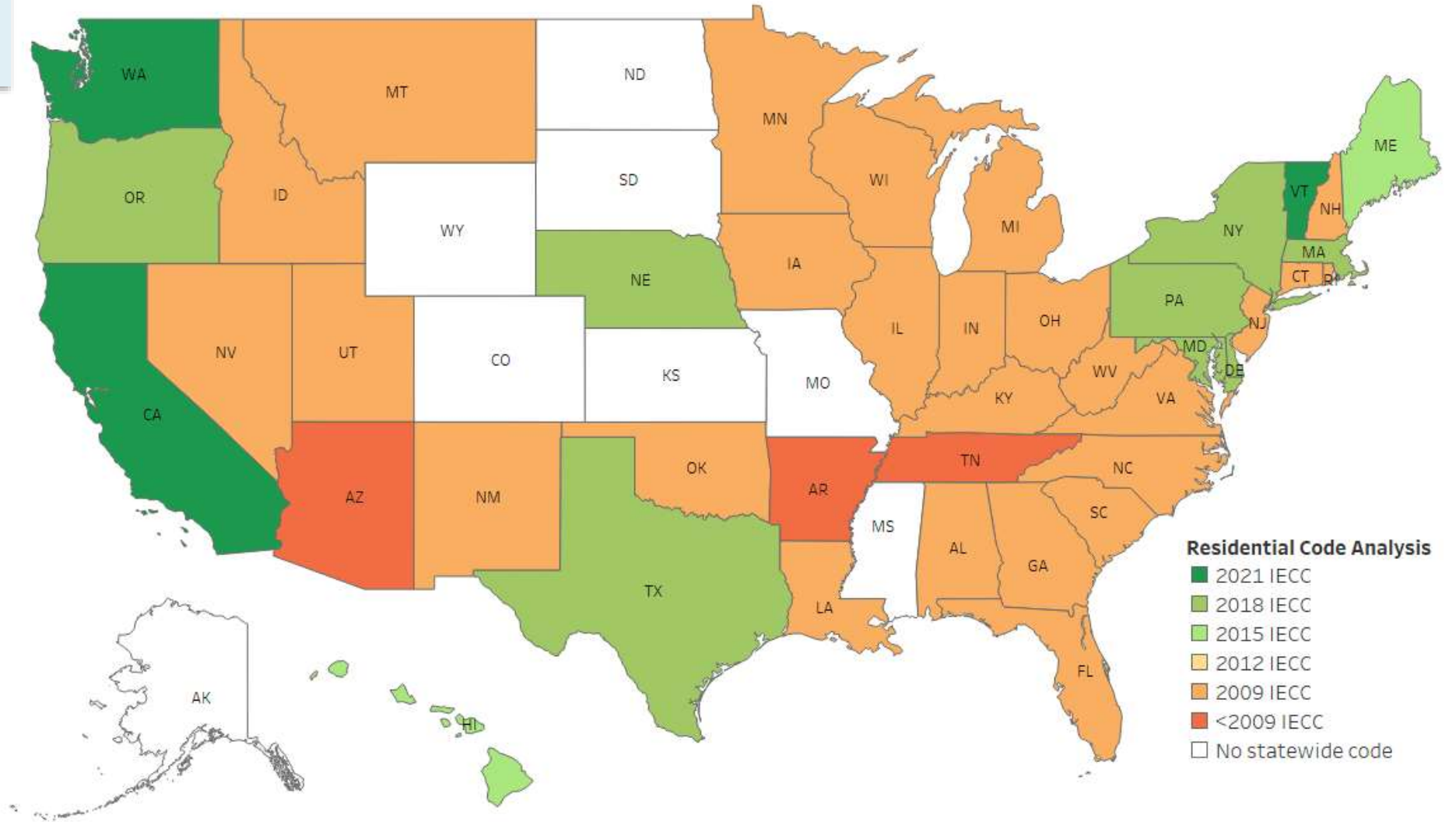
ESG & Embodied Carbon

Marketing

Use & Post-Sale

# Code

## Residential Buildings



Updated as of 03/31/22

Code



**SCEP**

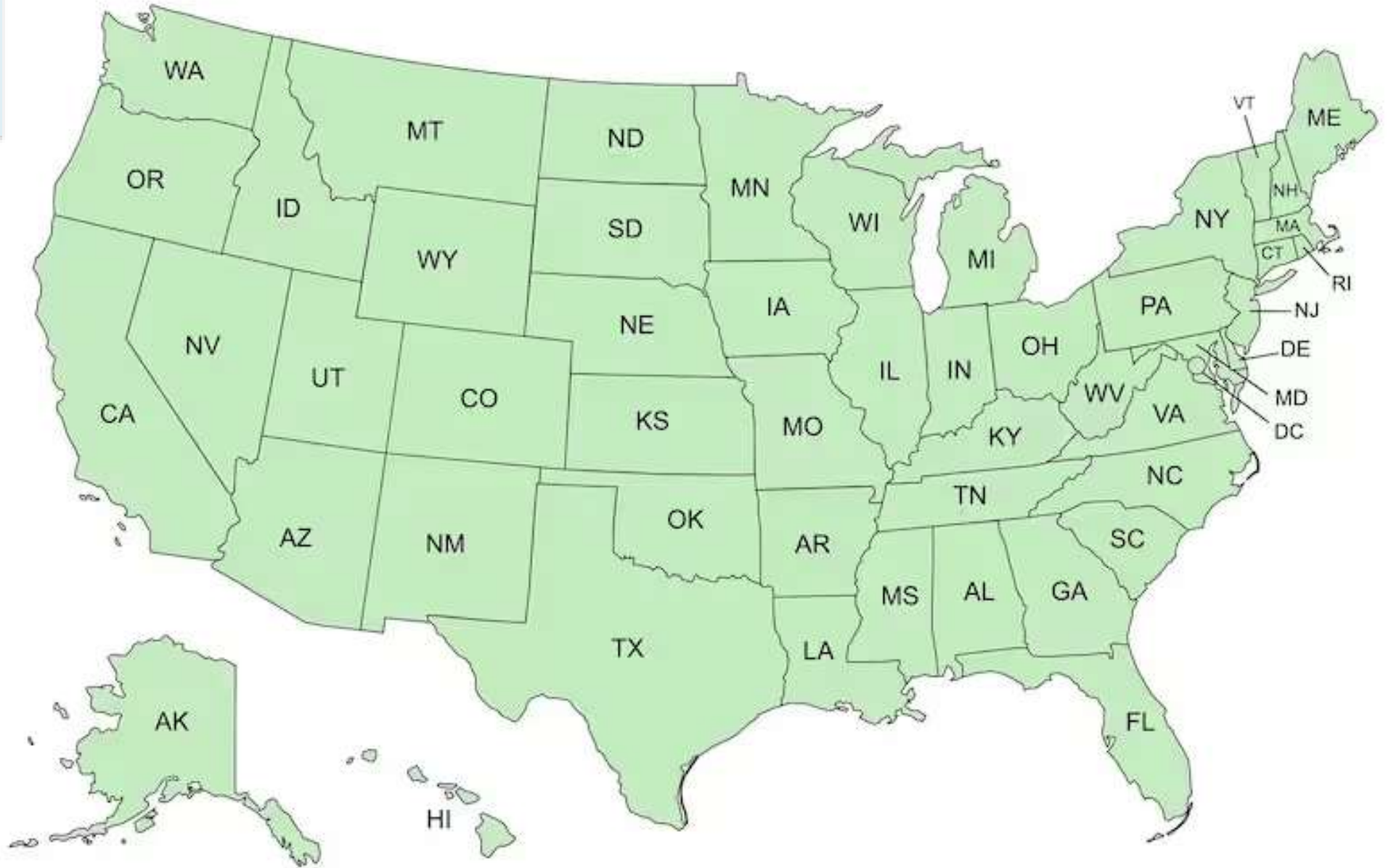
STATE & COMMUNITY ENERGY PROGRAMS

2021 IECC, or other codes with equivalent or greater energy savings

## IRA Funded Technical Assistance for Building Energy Codes

**\$1 Billion** in funding to make U.S. building stock cleaner and more efficient

# Code





# Code



# Code







- ENVELOPE
- SECTION R403 SYSTEMS
  - R403.1 Controls.
  - R403.2 Hot water boiler temperature reset .
  - R403.3 Ducts.**
    - R403.3.1 Ducts located outside conditioned space.
    - R403.3.2 Ducts located in conditioned space.
    - R403.3.3 Ducts buried within ceiling insulation.
    - R403.3.4 Sealing.
    - R403.3.5 Duct testing.
    - R403.3.6 Duct leakage .
    - R403.3.7 Building cavities .

**R403.3.6 Duct leakage .**

The total leakage of the ducts, where measured in accordance with Section R403.3.5, shall be as follows:

1. Rough-in test: The total leakage shall be less than or equal to 4.0 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m<sup>2</sup>) of *conditioned floor area* where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3.0 cubic feet per minute (85 L/min) per 100 square feet (9.29 m<sup>2</sup>) of *conditioned floor area*.
2. Postconstruction test: Total leakage shall be less than or equal to 4.0 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m<sup>2</sup>) of *conditioned floor area*.
3. Test for ducts within thermal envelope: Where all ducts and air handlers are located entirely within the *building thermal envelope*, total leakage shall be less than or equal to 8.0 cubic feet per minute (226.6 L/min) per 100 square feet (9.29 m<sup>2</sup>) of *conditioned floor area*.

**R403.3.7 Building cavities .**

*Building* framing cavities shall not be used as ducts or plenums.

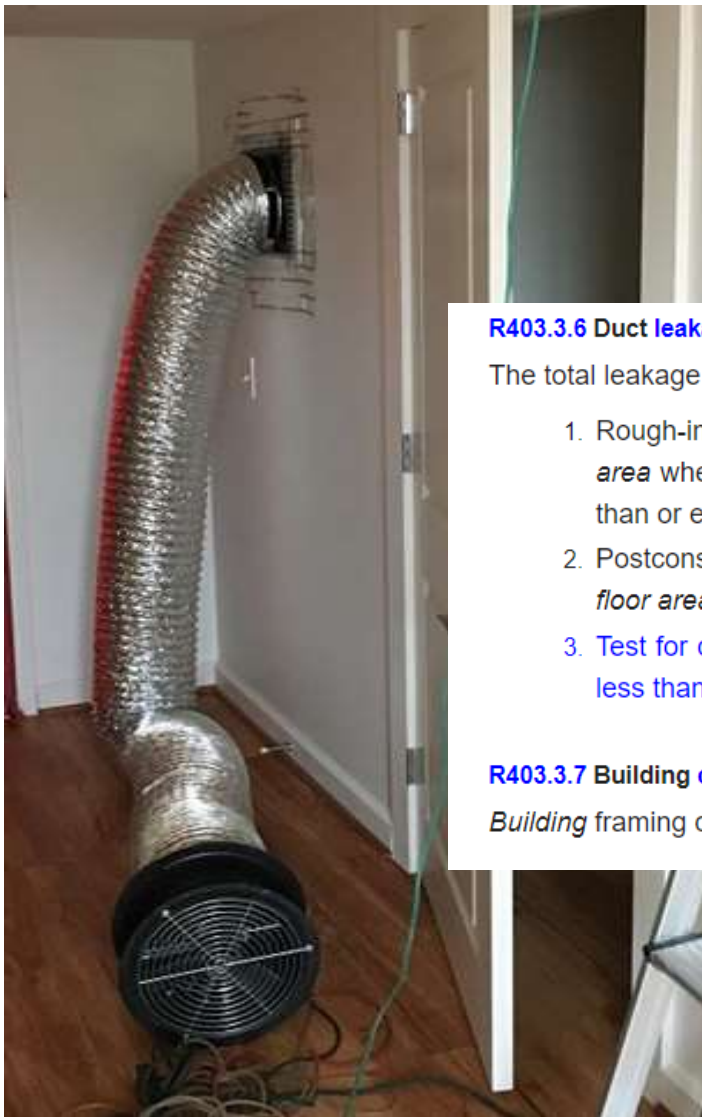
**R403.4 Mechanical system piping insulation. P**

Mechanical system piping capable of carrying fluids greater than 105°F (41°C) or less than 55°F (13°C) shall be insulated to an *R*-value of not less than R-3.

Premium Code Insights : Code Change Details Hearing Videos

**R403.4.1 Protection of piping insulation. P**

Piping insulation exposed to weather shall be protected from damage, including that caused by sunlight, moisture, equipment maintenance and wind. The protection shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall be prohibited.



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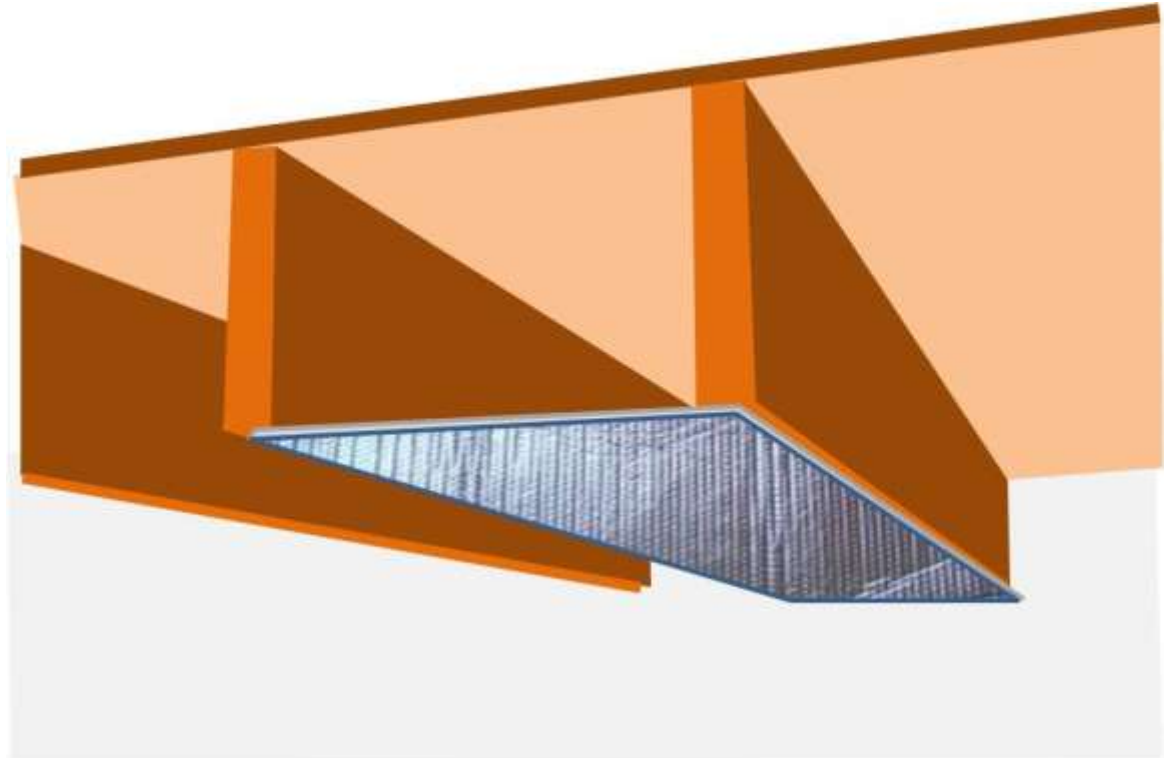
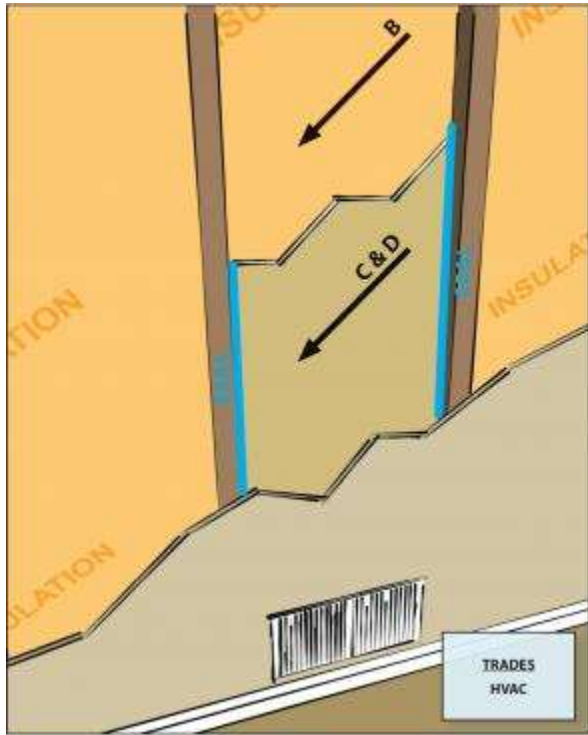
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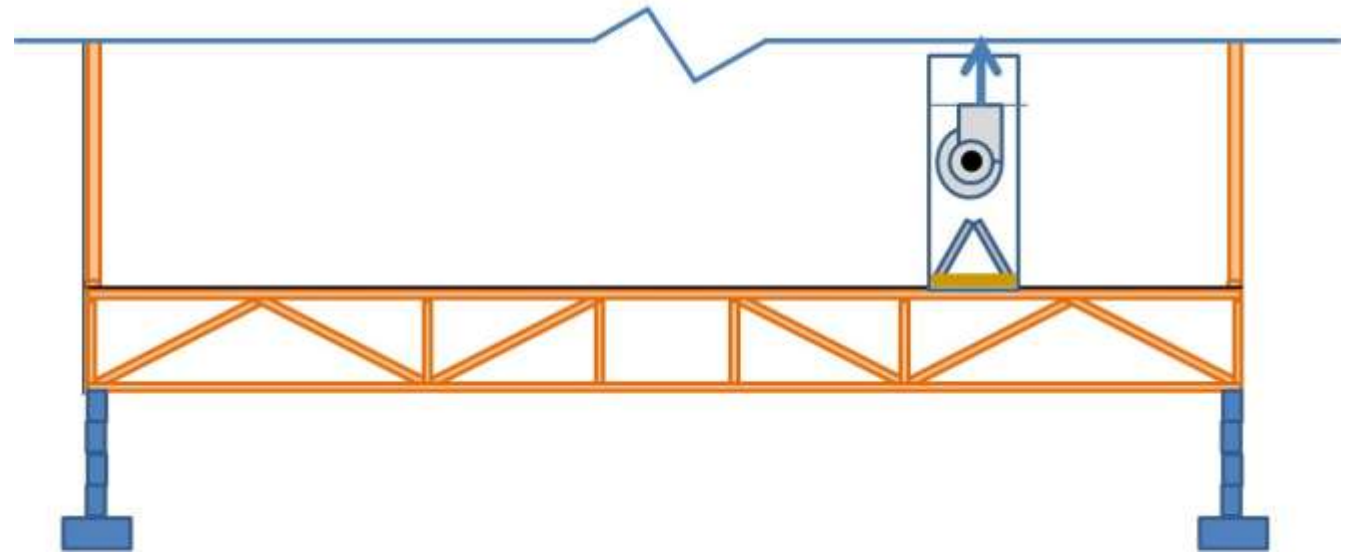
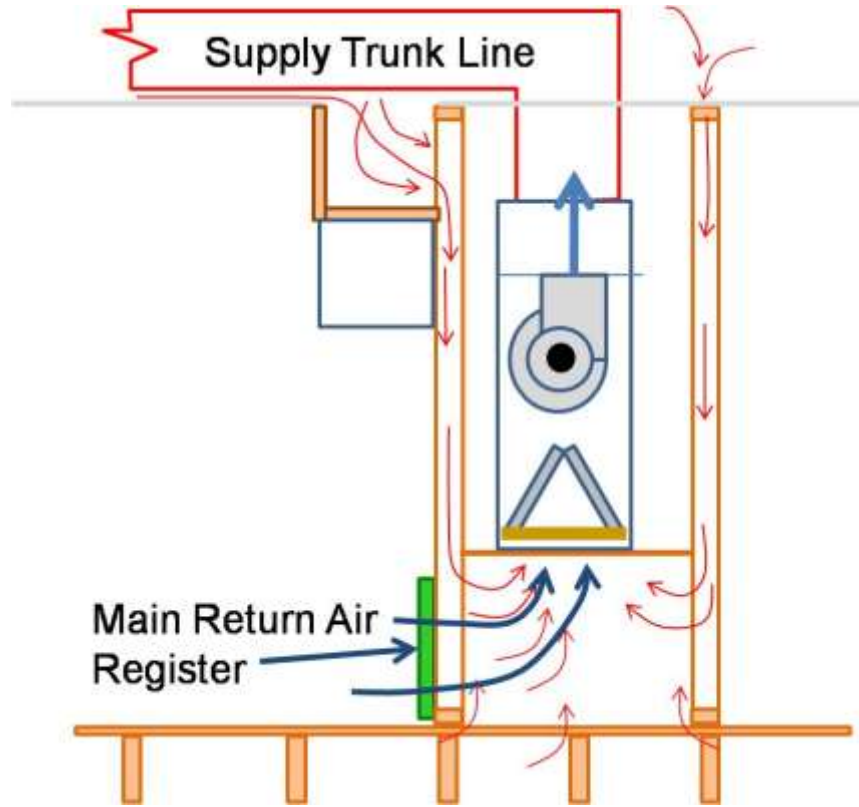
# Are these Building Cavities?



(Source: Courtesy of [CalcsPlus](#)).

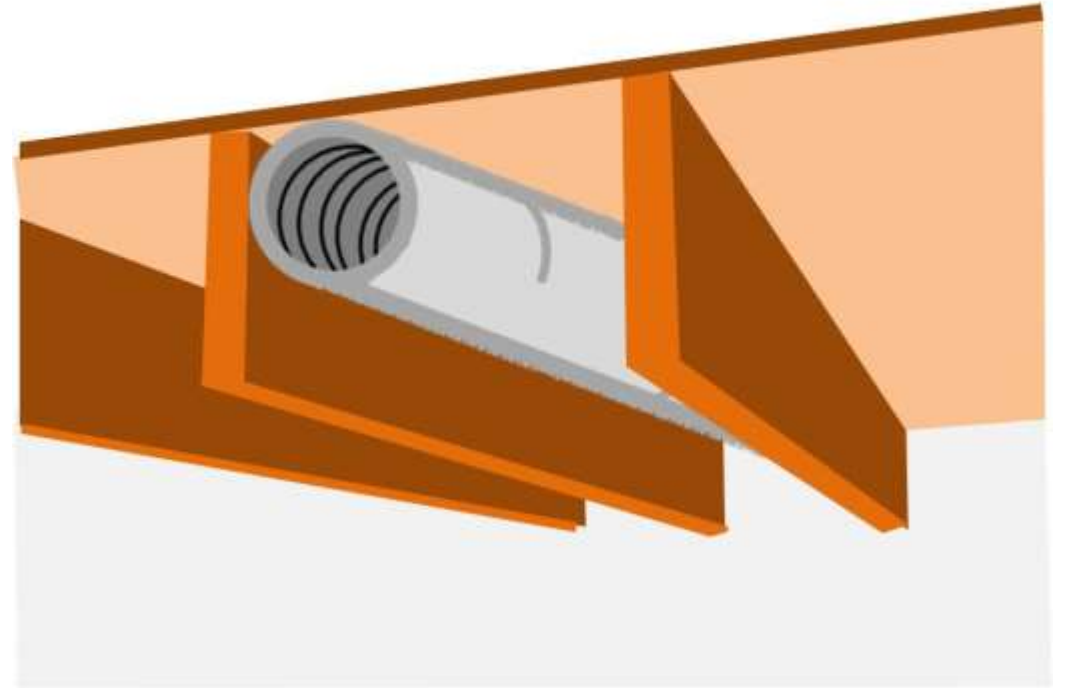
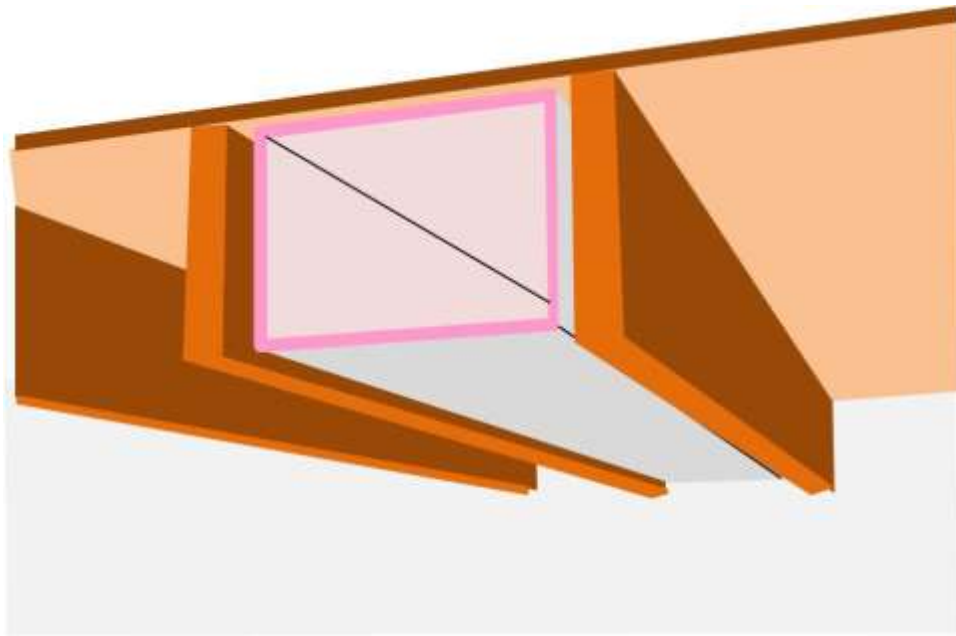
Source: Building America Solution Center

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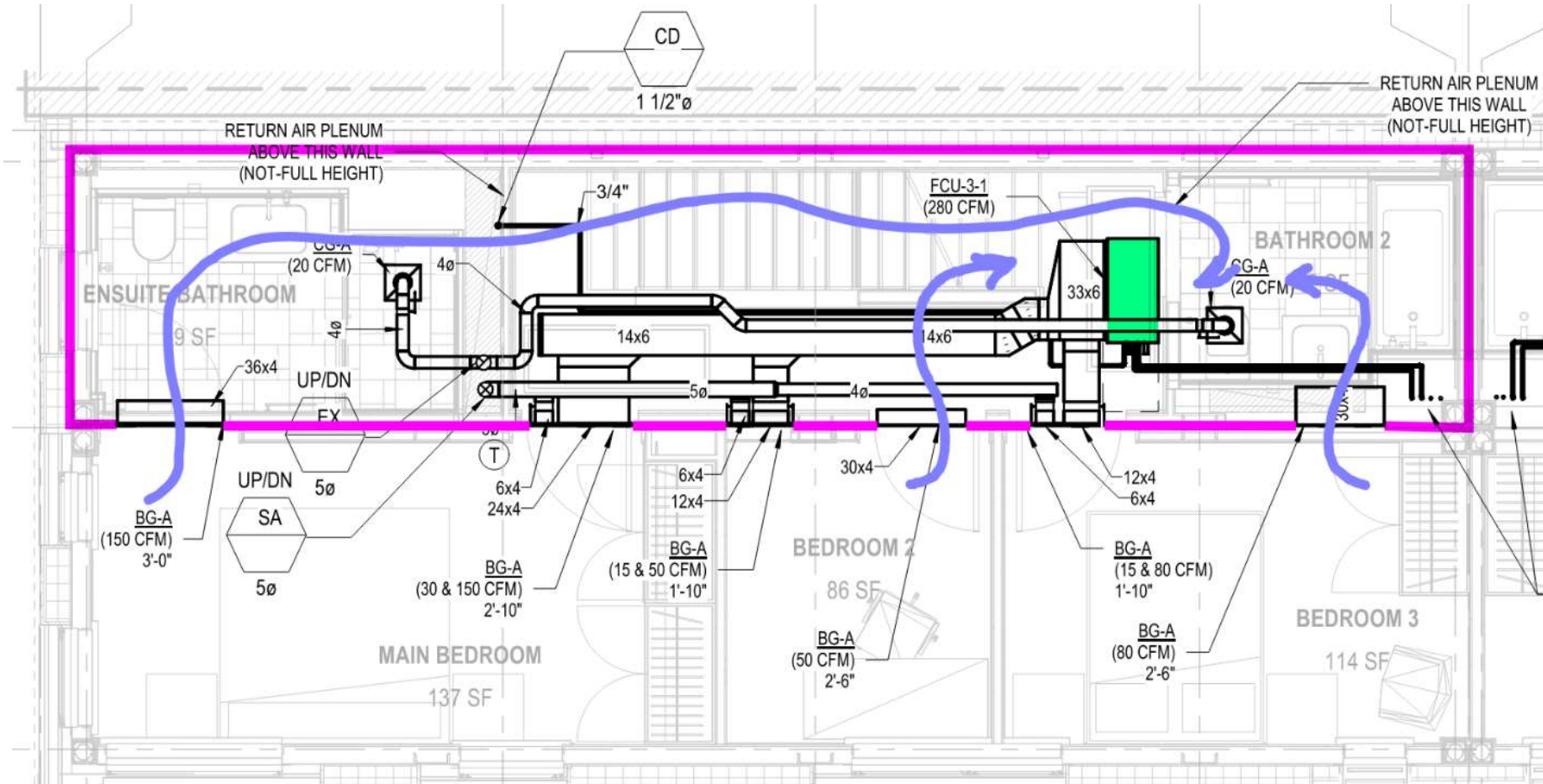


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# Are these Building Cavities??



# Are these Building Cavities???





# Code





# The Details: How to Make it Happen

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## Building Best Practices

ESG & Embodied Carbon

Marketing

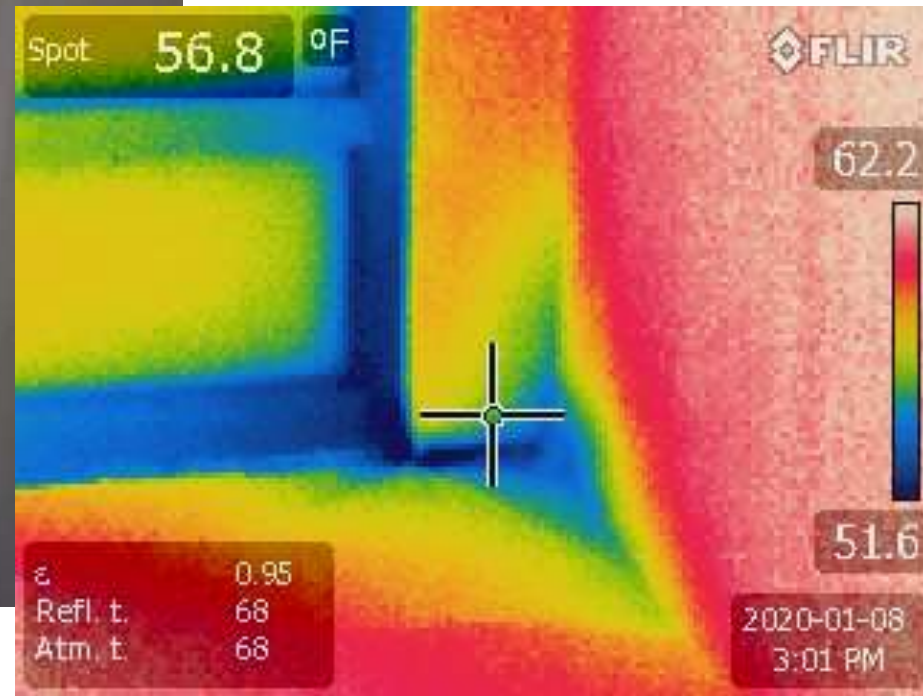
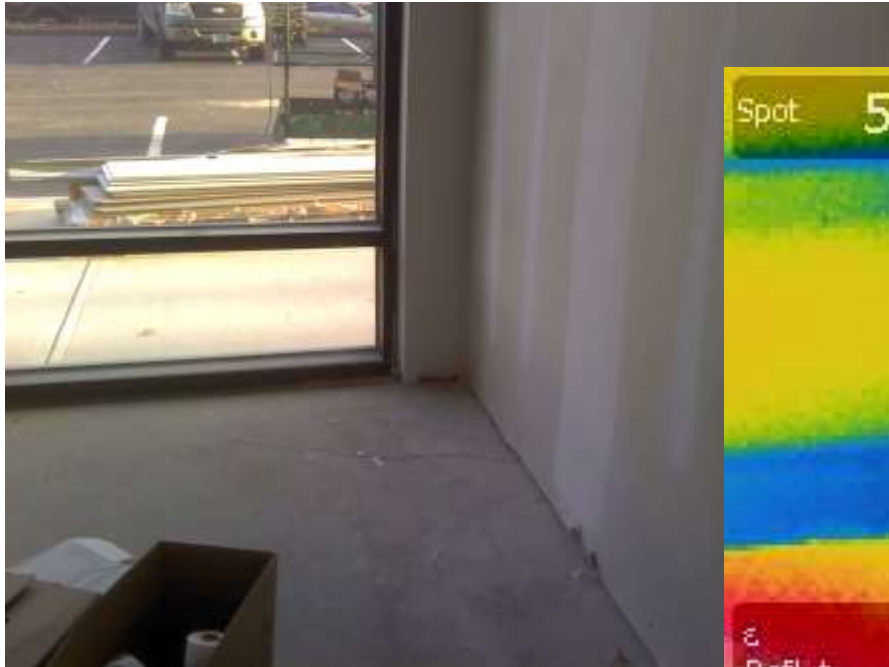
Use & Post-Sale



# Best Practices



# Best Practices

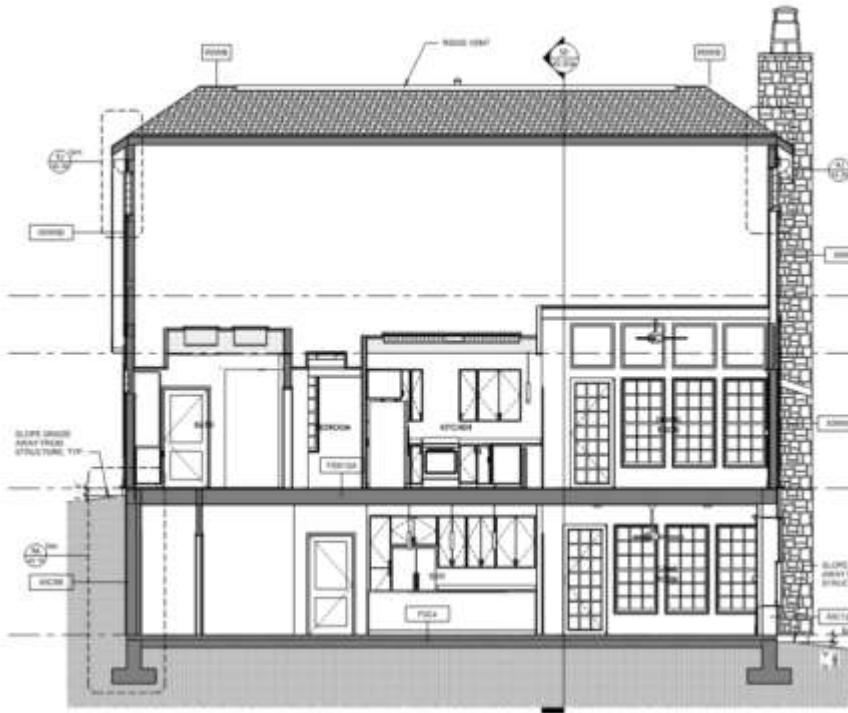




# Best Practices



# Best Practices

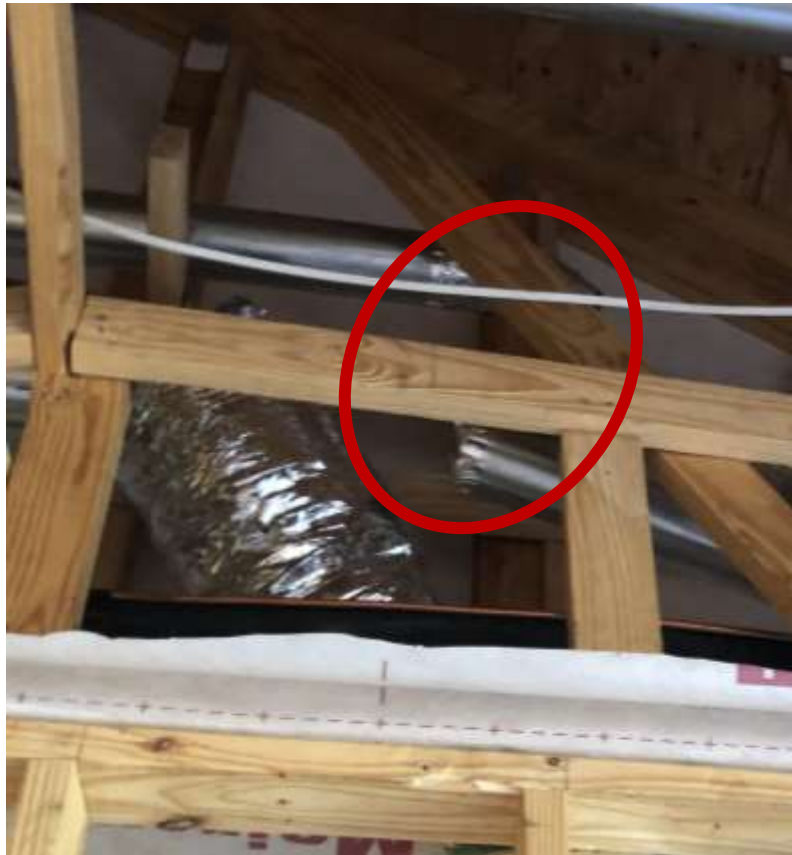


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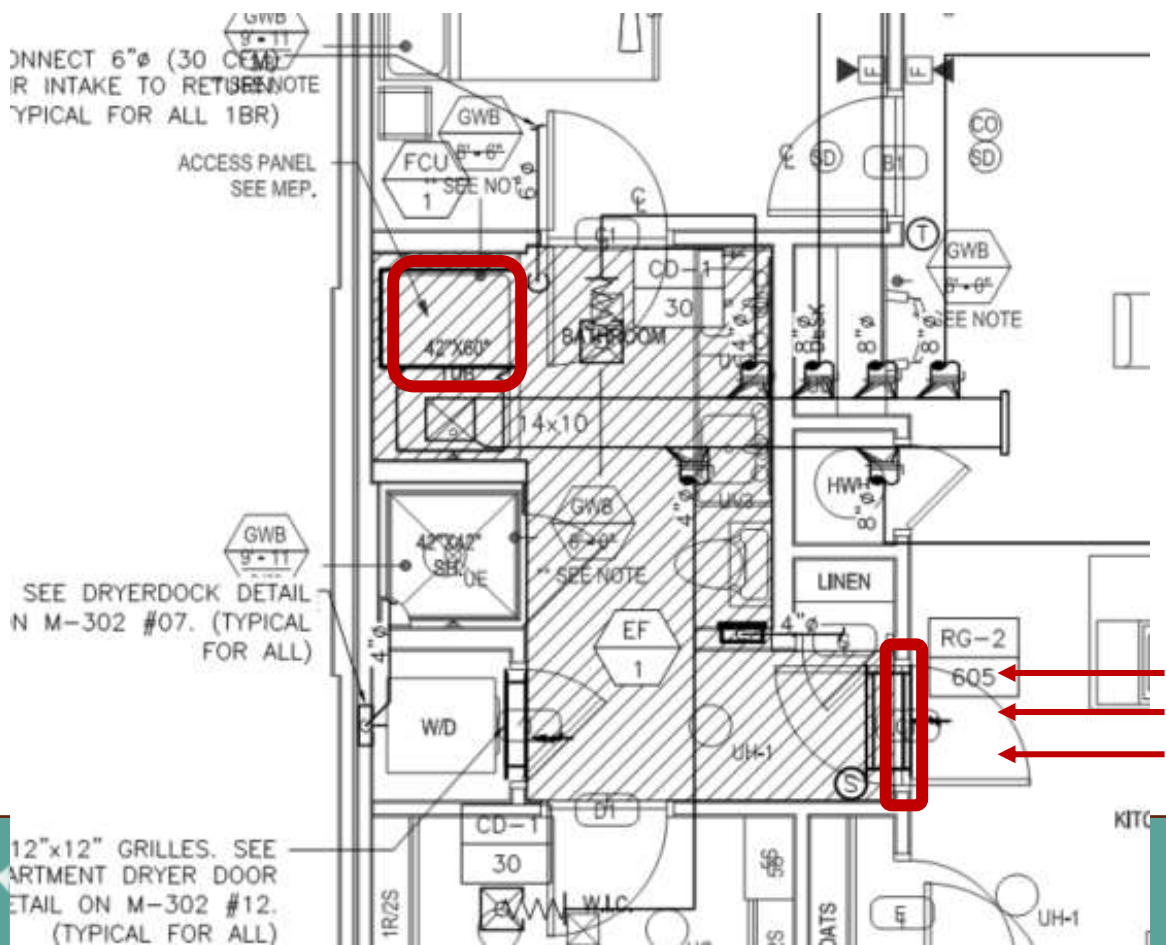




# Best Practices



# Best Practices



# Best Practices





# Best Practices





# The Details: How to Make it Happen

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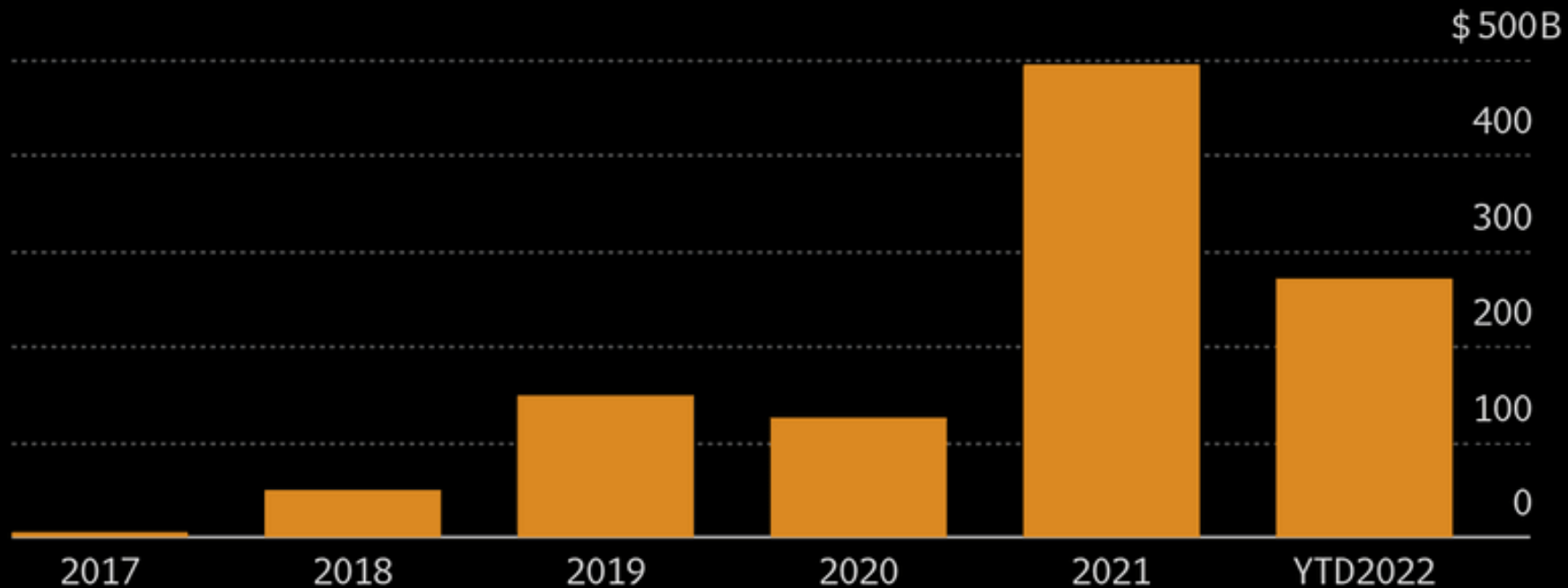
# Environmental Social Governance (ESG)



## ESG Loan Boom

Sustainability-linked loans are the fastest-growing component of ESG debt

■ Global SLL sales



Source: Bloomberg

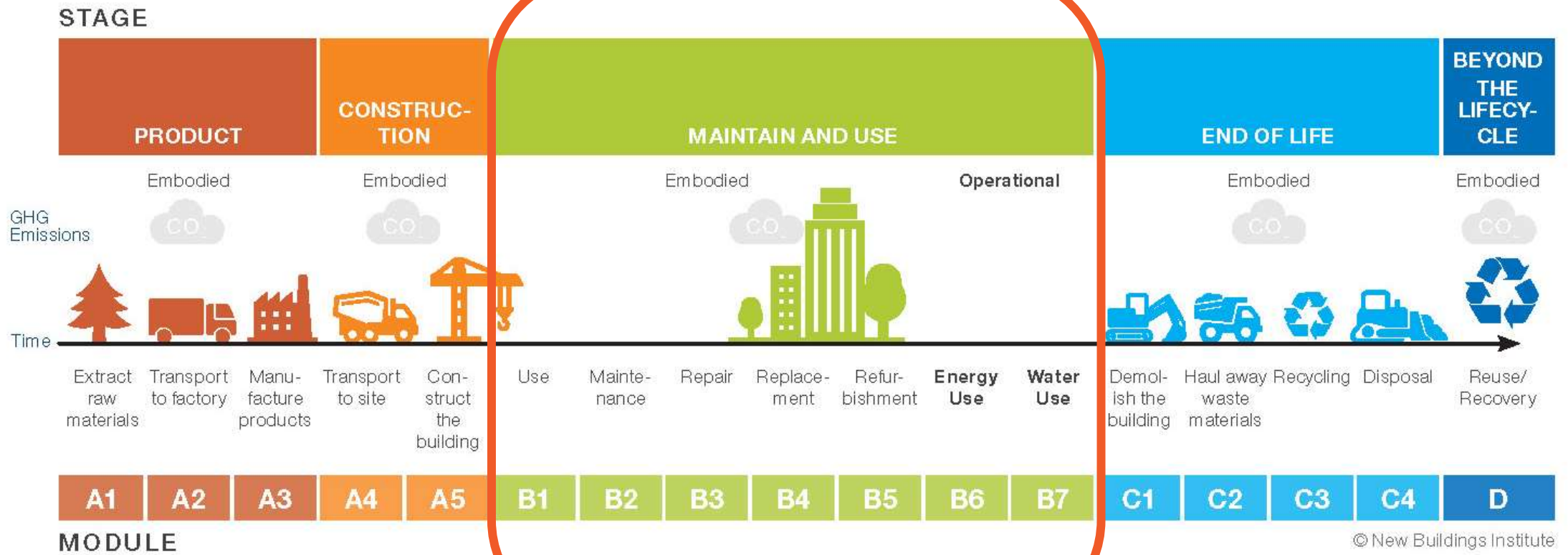
Note: All full-year volumes except for YTD2022

Bloomberg

# ESG



# ESG



## Embodied Carbon

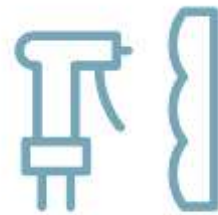
# Heavy Hitters



Concrete



Aluminum  
and Steel



Poly-based  
Insulation



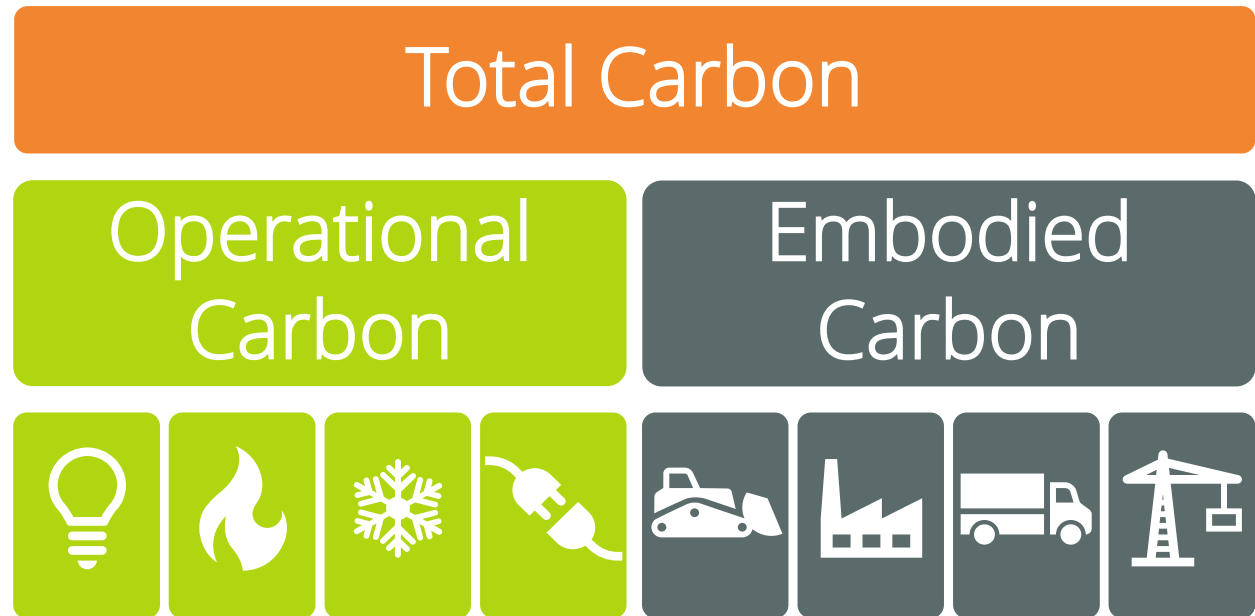
Glass



Refrigerant

# Embodied Carbon

# Accounting Tools



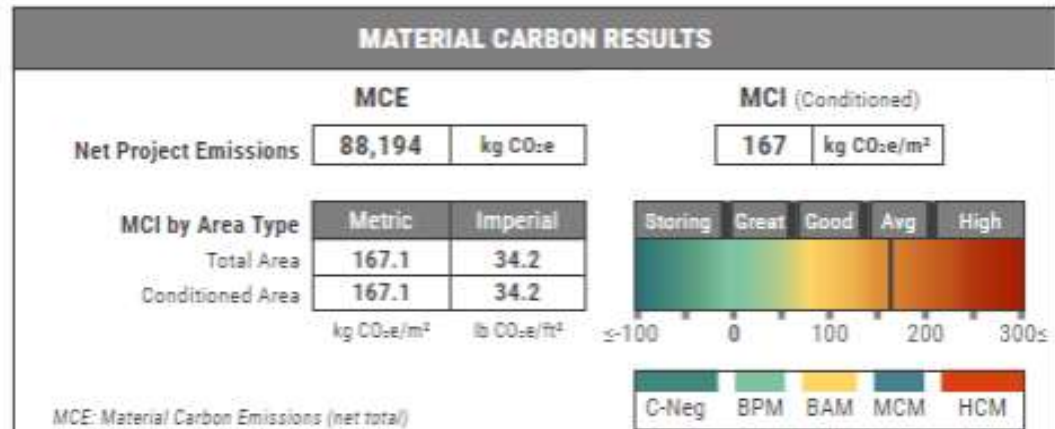
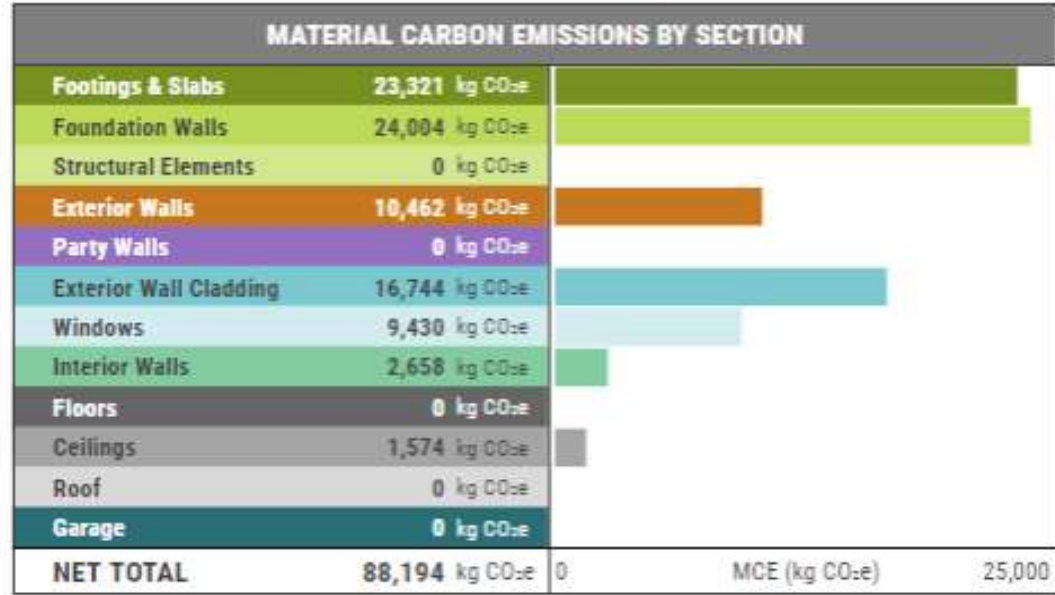


# Embodied Carbon



TOOL	Early Design Hotspot	Enclosure Comparison	Individual Material Comparison	LCCA + ESG	Net Zero Carbon	Residential	Retrofit Avoided Carbon	Whole Building LCA
<u>Autocase</u>				x				
<u>BEAM</u>						x		x
<u>Building Ease</u>			x					
<u>CARE</u>							x	
<u>COVE</u>	x							
<u>EC3</u>			x					
<u>Kaleidoscope</u>		x						
<u>OneClick</u>	x	x	x	x	x	x	x	x
<u>PH Ribbon</u>		x			x			
<u>Tally</u>	x	x	x	x	x	x	x	x
<u>ZGF</u>			x					

# Embodied Carbon





# The Details: How to Make it Happen

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## Marketing



- It cost more to build a better house and not every buyer is a true believer.
- Opportunities to reduce cost:
  - Utility Rebates
  - State Incentives
  - Federal Tax Incentives (Substantially Grown with IRA)
  - Reduced Opportunity Costs
  - Increased Land Opportunities



# Marketing



Home Type	\$500 credit	\$1,000 credit	\$2,500 credit	\$5,000 credit
Single-Family Home Acquired Before 1/1/2025	N/A	N/A	Energy Star v3.1 + Regional Energy Star Requirements (1)	DOE ZERH
Single-Family Home Acquired On/After 1/1/2025	N/A	N/A	Energy Star v3.2 + Regional Energy Star Requirements (1)	DOE ZERH
Manufactured home	N/A	N/A	Energy Star Manufactured standard (1)	N/A
Multi-family home	Energy Star MF NC	DOE ZERH	Energy Star MF NC (1) + Prevailing Wage	DOE ZERH + Prevailing Wage



- Tax credit on 30% of qualified expenditures made for property placed into service beginning 2022 through 2032 for the following technology:
  - Solar Panels
  - Solar Water Heater
  - Fuel Cells
  - Small Winder Energy
  - Geothermal Heat Pump
  - Battery Storage
- **Tax credit goes to owner of equipment.**



## Energy Efficient Home Improvement

- Only for existing homes
- Changed from a \$500 lifetime credit to up to \$3200 credit for homeowner.
- Available for the following improvements:
  - Exterior doors, windows, and skylights
  - Insulation and Air sealing materials
  - HVAC equipment
  - Water heaters
  - Improvements to some electrical infrastructure



# The Details: How to Make it Happen

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## Use & Post-Sale



- **Make sure the system works as designed at closing**
- **Register all equipment with manufacturer to secure and extend manufacturer warranty**
- **Provide the homeowner education about the home**
- **Provide “one box” service to annually deliver every filter the home needs**
- **Visit home twice a year to inspect and service equipment**

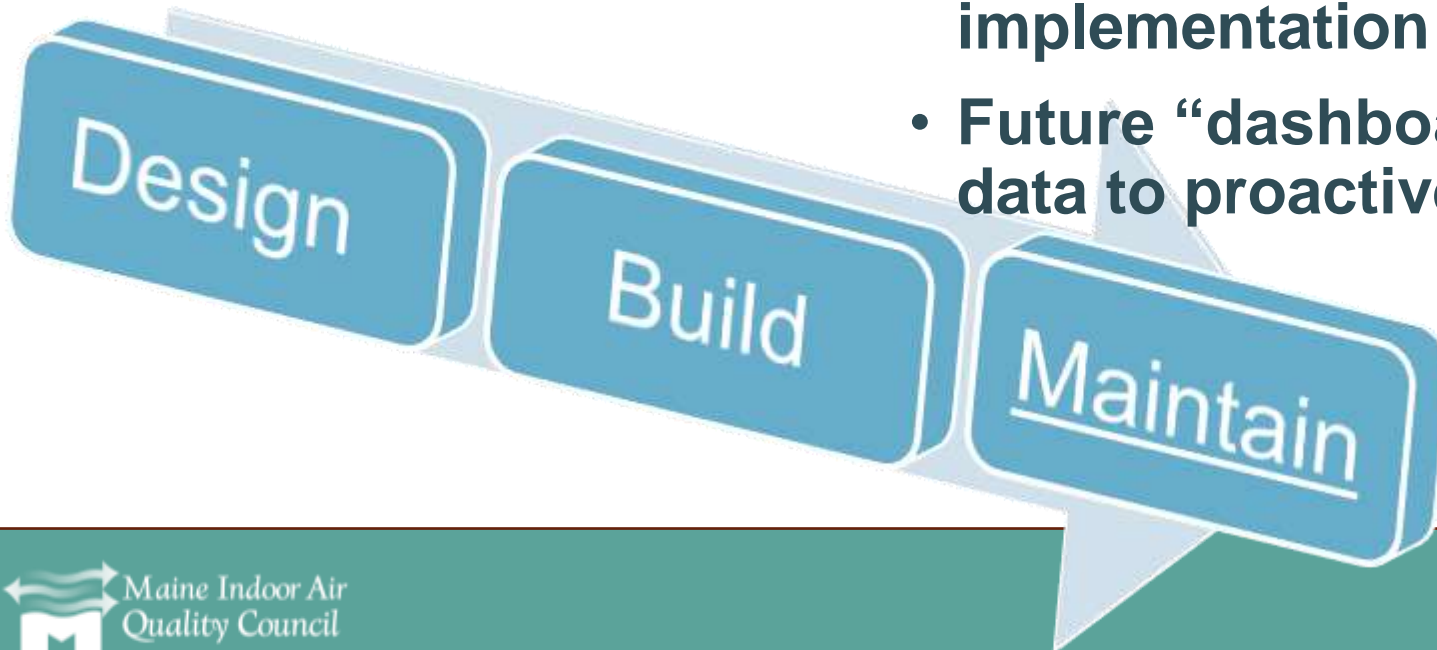
## Use & Post-Sale



- **Collection of data regarding component reliability**
- **Enhance the reputation of our homes as working as well in the future as they do at closing**
- **By maintaining customer relationship, increase satisfaction and build the brand**
- **Inform extended warranty program for future implementation**
- **Future “dashboard” of real time performance data to proactively troubleshoot issues**

## Use & Post-Sale

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# Get to Know the Household



Every household makeup is different, and each lives differently and has unique needs



# Living in the Home



Asthma or Allergy Concerns



Presence of Pets



Priorities – Energy Efficiency. IAQ.

**DWELL** Household Questionnaire

HOMEOWNER INFORMATION  
Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Email Address: \_\_\_\_\_

# Of People Living in Your Home?  
Adults: \_\_\_\_\_  
Children: \_\_\_\_\_

Any Smokers?  
 Yes  No

Asthma or Allergies?  
 Yes  No

# of Pets?  
 Dogs  Cats  Other

Culinary Skills?  
 We don't cook much  
 We cook a lot  
 Somewhere in between

Laundry Habits?  
 Dirty clothes tend to pile up (many loads in one day)  
 I'm doing a load of laundry every day  
 Somewhere in between  
 I use fabric softener sheets when I dry clothes

Desired Water Temperature  
 Goldilocks – not too hot/not too cold  
 We like it hot

**How Important is Energy Efficiency to You?**  
 Important  
 Very Important  
 Super Important

**How Important is Indoor Air Quality to You?**  
 Important  
 Very Important  
 Super Important

**WHY DO WE ASK?**  
Your household's lifestyle and personal habits help determine the specific maintenance your home's components require to continually perform in an efficient and healthy manner.



# Get to Know the Home



**Inventory the Components**  
(HVAC, Kitchen & Laundry Appliances)



**Determine Maintenance Requirements**

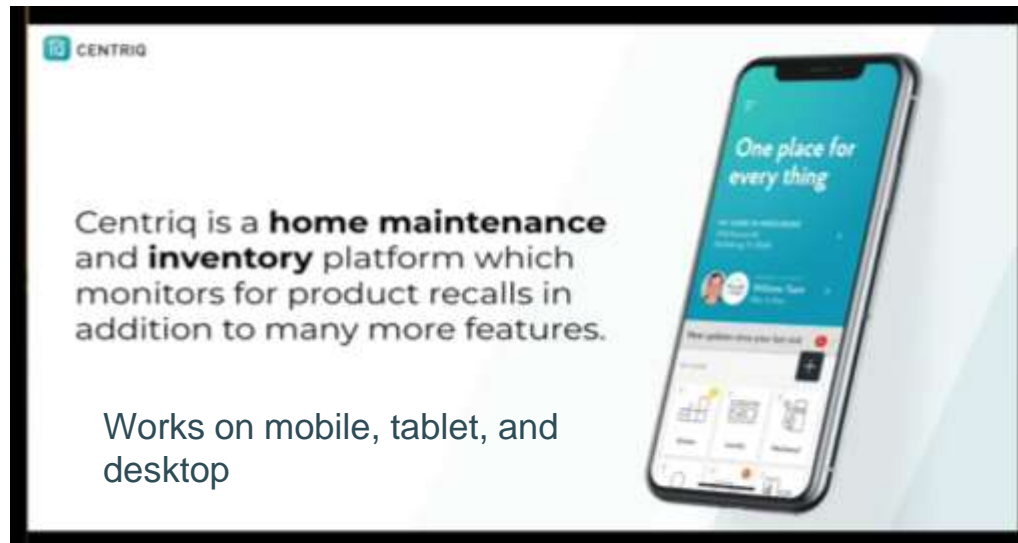


**Identify the “Consumables”**  
(Filters, and Batteries)



**Define Responsibilities**  
D.I.Y. (Do it Yourself vs. H.A.P. (Hire a Pro)

# Create Digital Home Records/Inventory



## Make, Model & Serial Numbers

Repair Reference, Life Expectancy



## Digital Product Documentation

Owner's Manuals, Warranty, Maintenance



## Maintenance Task Setup

Manufacturer's Recommendations, Email Reminders



## Document Storage

Energy Certificates (HERS Score, Indoor airPLUS, LEED Certificate, Energy Star, Service Records, Extended Warranties)



## Use & Post-Sale



A valuable 1<sup>st</sup> year Closing Gift to the home buyer and the home.



## Procure the “Consumables”

Air Filters, Water Filters,  
Water Panels, Batteries

*Less Excuses*

Combined with the maintenance task reminders set up in the App, a homeowner enjoys the convenience of pulling the needed item out of the Annual “Consumables” box and completing the necessary task immediately... no need to extend the task by having to go to a big-box hardware store or order online. Less likely for the task to be forgotten!

## Use & Post-Sale

- Provide concierge service coordinate
- recommended annual checkups on HVAC and plumbing equipment
  - Input service call documentation into the app



**Cooling Season Tune-Up**  
Late March/Early April)



**Heating Season Tune-Up**  
Post Labor Day



**Water Heater Descale**

# Annual Cost of Services



**Tier 4**

**Tier 3**

**Tier 2**

**Tier 1**

## **A La Carte**

\$ job specific

Sprinkler Turn-On/Off, Pest Control, etc.

## **Annual Professional Visits**

**\$550 - \$600**

Mechanical – HVAC Tune-Ups

Plumbing – Tankless Water Heater Descale

## **Box of Annual Consumables**

**\$350 - \$750**

(Cost-Plus Convenience Fee)

## **Digital App & Set Up (1<sup>st</sup> Year)**

**\$200 - \$250**

Inclusive of annual app fee



# Use & Post-Sale



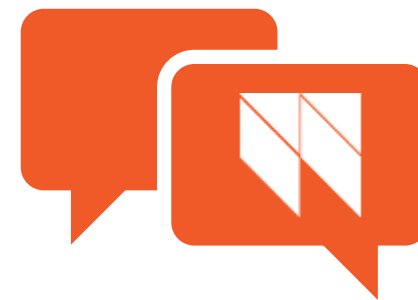
Beyond the Closing



Beyond the Warranty Period



For the Lifetime of the Owner's Tenure in the Home



# Contact Us

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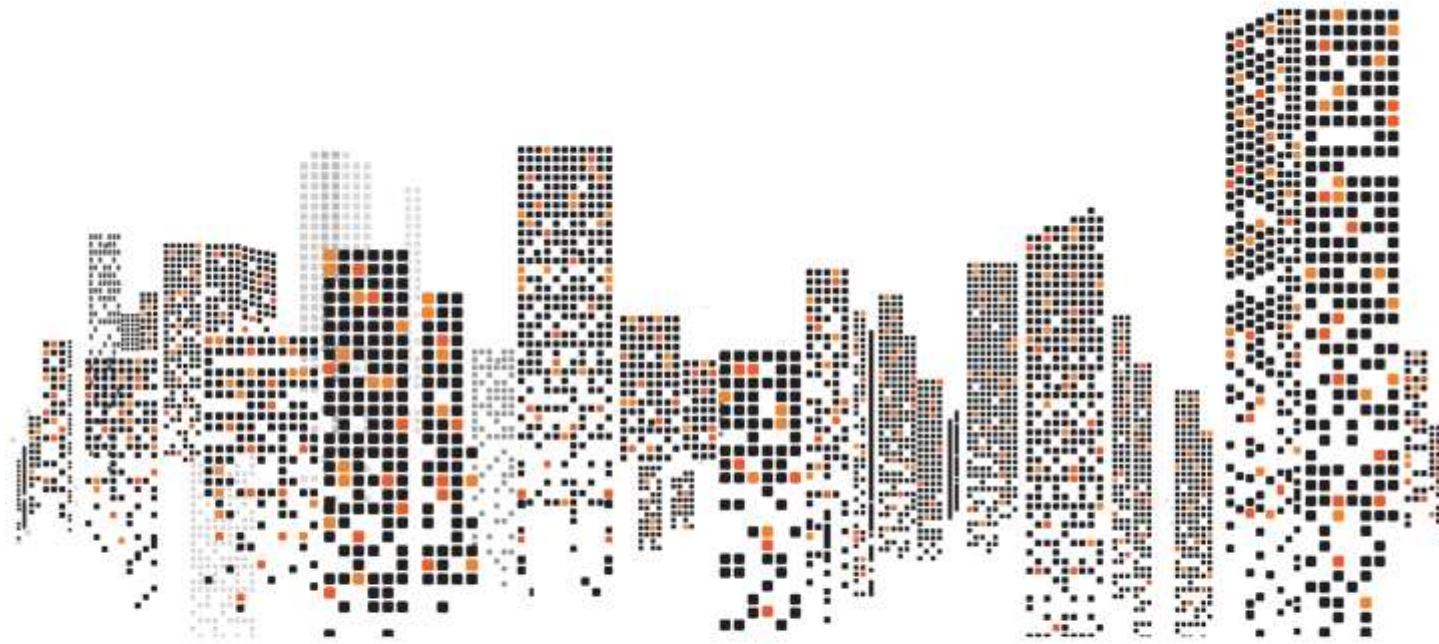
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