TRI-COUNTY
REGIONAL ENERGY NETWORK
SAN LUIS OBISPO • SANTA BARBARA • VENTURA

Builder's Perspective: Insulation and Air Sealing

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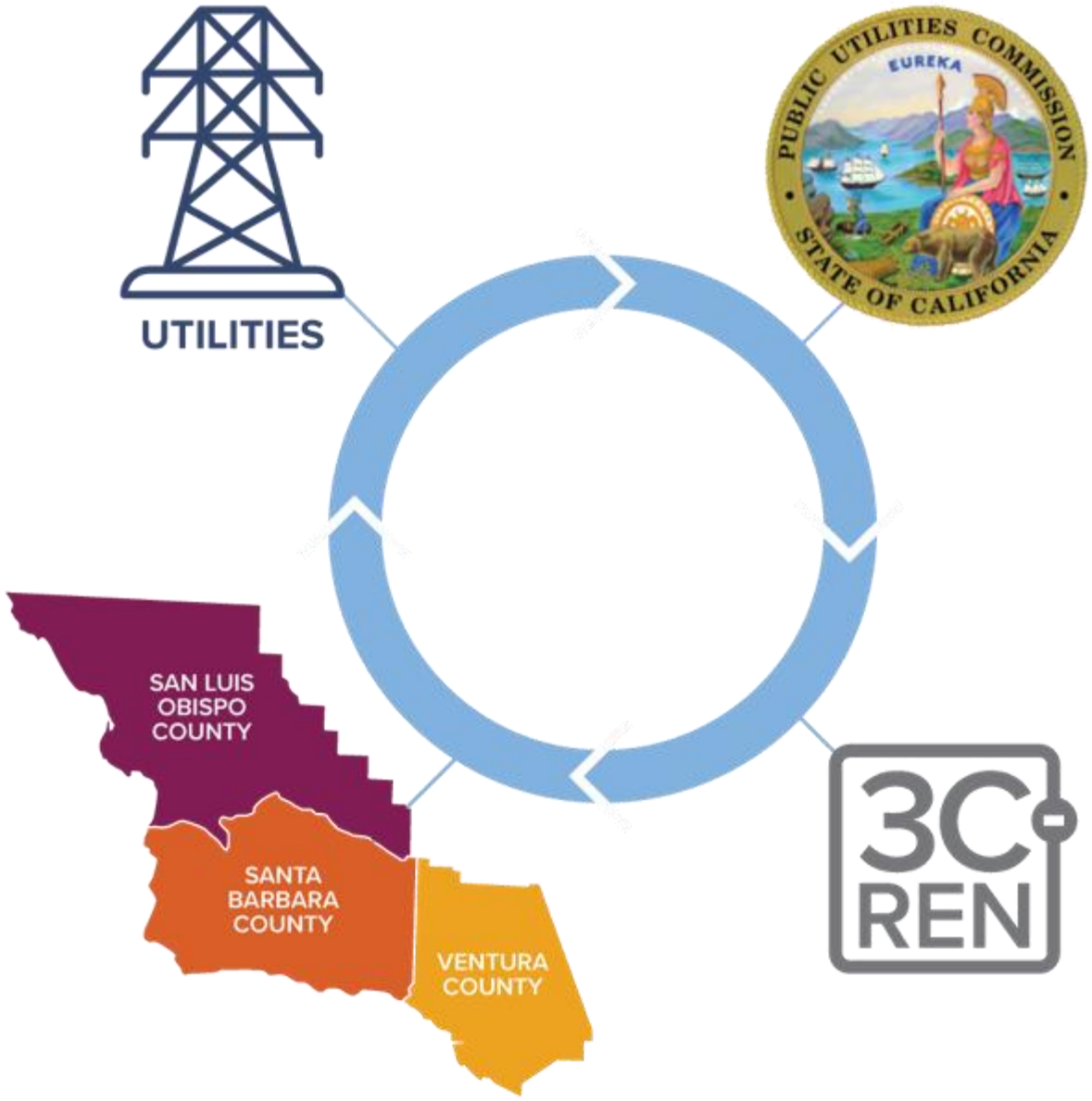
May 26, 2026

Before We Begin

Here are some quick reminders:

- Call in? Please **share** full name to confirm attendance
- To receive AIA LUs, you **must attend** at least 80% of the training. Attendance will be verified
- Use the "**Chat**“ to share questions or comments
- Slides/recording are **shared** after most events and can be found on 3C-REN's on-demand page
- 3C-REN does **not** allow **AI notetakers**, unless used to accommodate a disability



Tri-County Regional Energy Network

3C-REN is a collaboration between the tri-counties

Our programs reduce energy use for a more sustainable, equitable and economically vibrant Central Coast

Our free services are funded via the CPUC, bringing ratepayer dollars back to the region

Our Services

Incentives

HOME ENERGY SAVINGS

3c-ren.org/for-residents
3c-ren.org/multifamily

COMMERCIAL ENERGY SAVINGS

3c-ren.org/commercial

Contractors can enroll at
3c-ren.org/contractors

Training

BUILDING PERFORMANCE TRAINING

3c-ren.org/events
3c-ren.org/building

ENERGY CODE CONNECT

3c-ren.org/code

View past trainings at
3c-ren.org/on-demand

Technical Assistance

AGRICULTURE ENERGY SOLUTIONS

3c-ren.org/agriculture

ENERGY ASSURANCE SERVICES

3c-ren.org/assurance

3C REN

Today's Learning Objectives

Insulation and air sealing contributes to improved energy performance, reduced operating costs, greater indoor air quality and resiliency during a wildfire emergency. Insulation and air sealing can also contribute to increased construction costs and challenges for building sign-off if not managed effectively. In this course, we'll hear the builder's perspective for sequencing the work, selecting materials, training teams on site and getting the results you want.

Learning Objectives

- Talk through options for insulation and air and vapor barriers and best practices for selecting and installing each
- Review the potential negative consequences of thermal bridging in walls and roofs and discuss assemblies that avoid those outcomes
- Learn the application and benefits of rain screens in the central coast climate and different techniques and materials for a rain screen assembly
- Learn big and little spaces that are problem-areas in air sealing and how to use catch them early in construction

Learning Units

- 1.0 AIA LU
- 1.0 CAB ZNCD CEU

Agenda

1. Set-the-Stage: Energy Code, Construction Costs, and a Builder's Perspective
2. Foundations and Slabs
3. Walls, Insulation and Rainscreens
4. Roofs/Ceilings and Attics
5. IAQ and Wrap Up

Builder's Perspective

Insulation and Air-Sealing:

1. Weather and Water tight: no leaks, no lawyers
2. Thermally tight: no paths, no bridges, no highways
3. Air tight: keep unwanted air out; keep conditioned air in

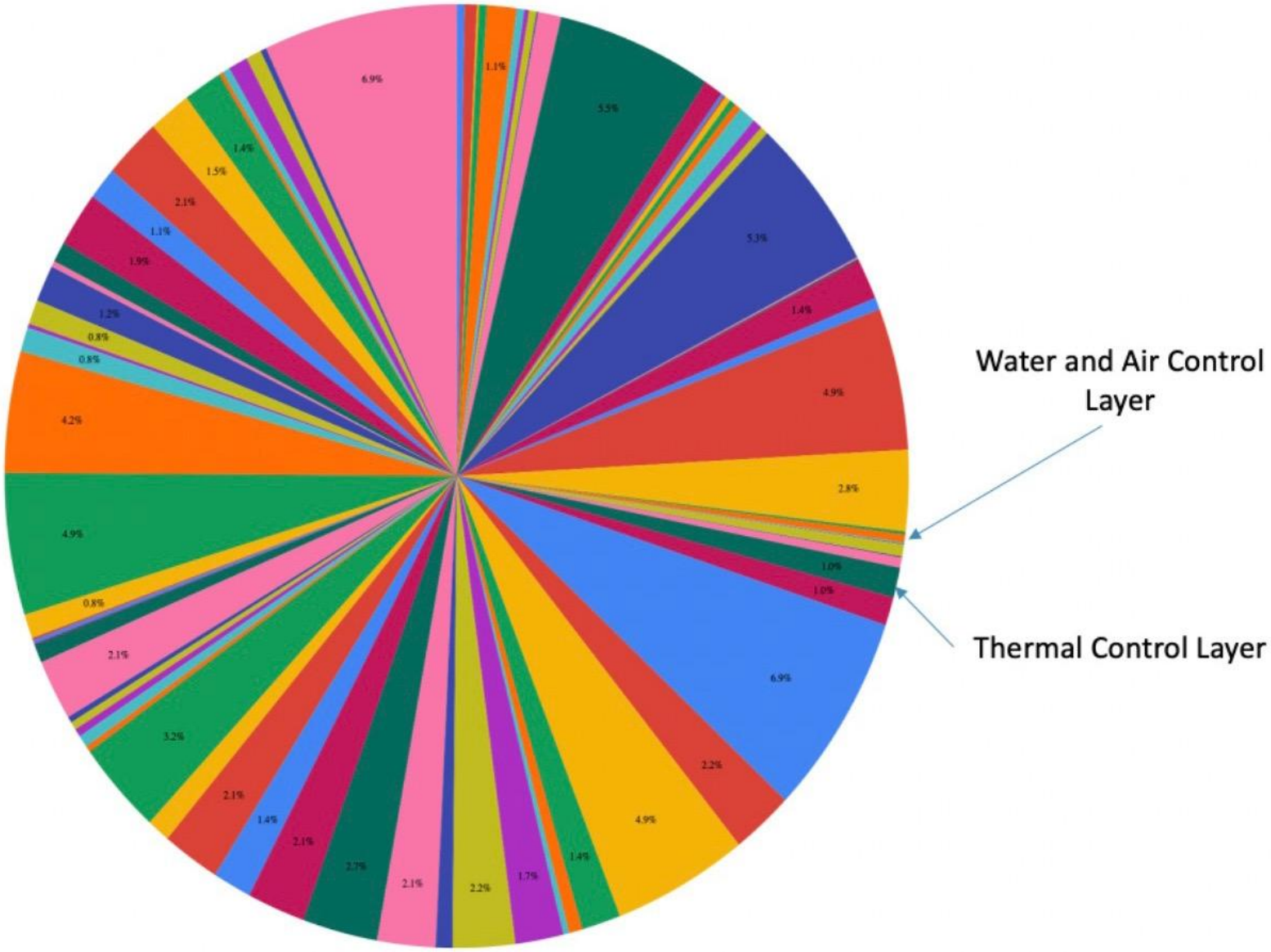
The Energy Code Requires Better Insulation and Better *Installation*

- New Insulation Materials and Standardized Testing
- Higher R-values
- QII and HERS* Introduced into the Code…

  which requires the on-site verification of insulation and *air-sealing*

**Note: HERS is now called ECC for "Energy Code Compliance"*

Relative Cost of Insulation and Air-Sealing



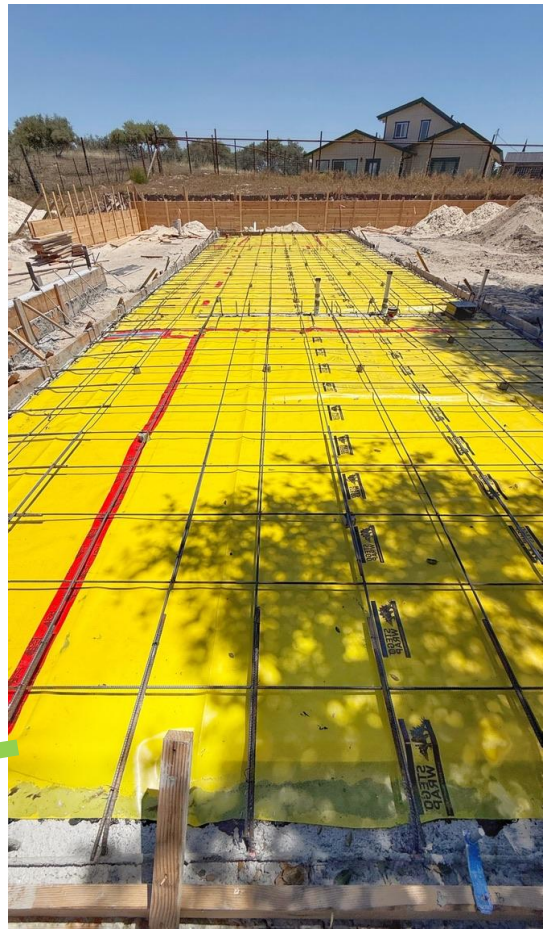
Foundations and Slabs

Under the Vapor Barrier –Slab on Grade

Glavel aggregate compacted

Mastic is brush applied to concrete footing or grade beam

Stego 15 mil vapor barrier is applied directly over aggregate.



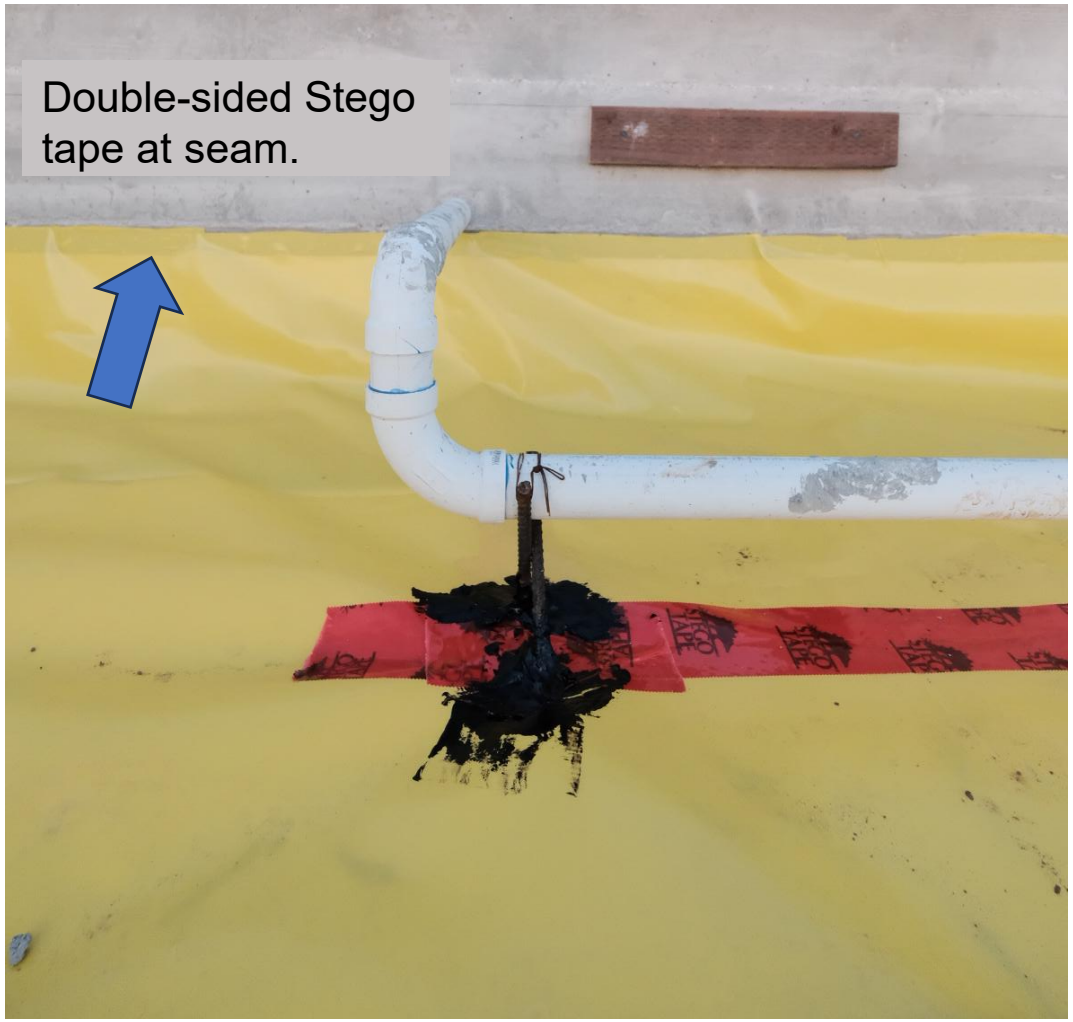
American Concrete Institute (ACI 302.1 R-15) recommends 10 mil minimum vapor barrier meeting ASTM E96 for permeability and calls for the concrete to be placed **directly on** the vapor barrier.

Note:
Sand adds moisture and extended dry times.
Choose under-slab materials with insulative value (Glavel, rigid insulation, etc)

Concrete Poured Directly onto Vapor Barrier

Note:
Sand adds moisture; extended dry times; and mildew risk.
Choose under-slab materials with insulative value (Glavel, rigid Insulation, etc)

Vapor Barrier – Seams Sealed and Adhered to Foundation Walls



Class I Vapor Barrier < 0.1 perms
Prevents Vapor Drive and Moisture Migration

Use specialized tape and/or mechanical fasteners – typically sold with the vapor barrier -- securely attached to the foundation

Use specialized tapes to temporarily hold the vapor barrier to the foundation prior to a slab pour

Controlled Ventilation Crawl Spaces

Items to Keep in Mind

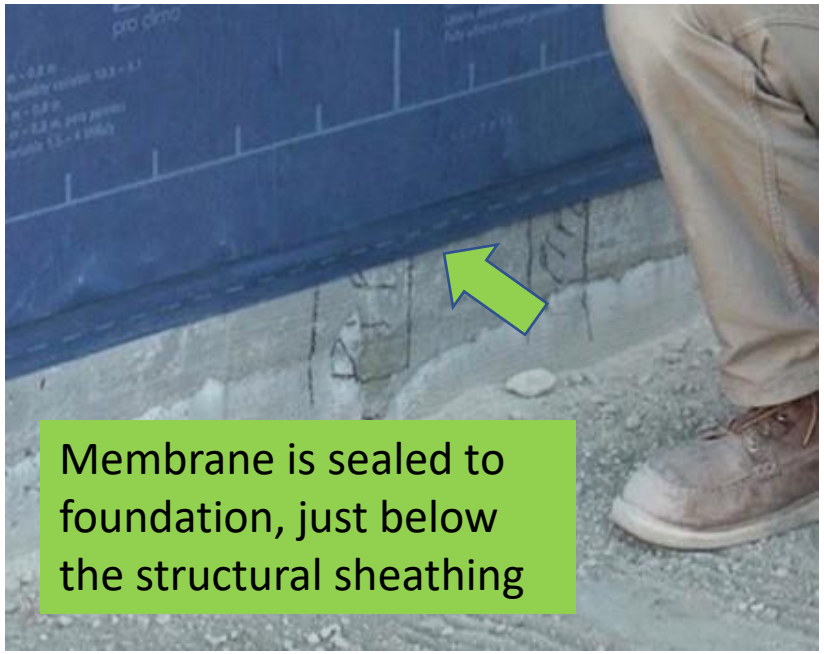
1) Exposed earth shall be covered with a Class I or Class II Vapor Retarder

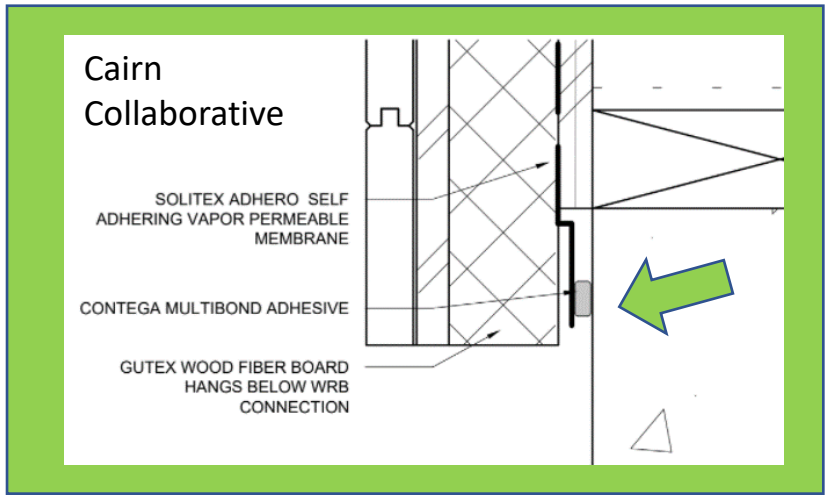
2) Automatically operated temperature actuated vents to the outside (RA4.5.1)

3) * Dirt Smells

Less Concrete with Raised & Insulated floors

Wall to Foundation Air-tight Connection



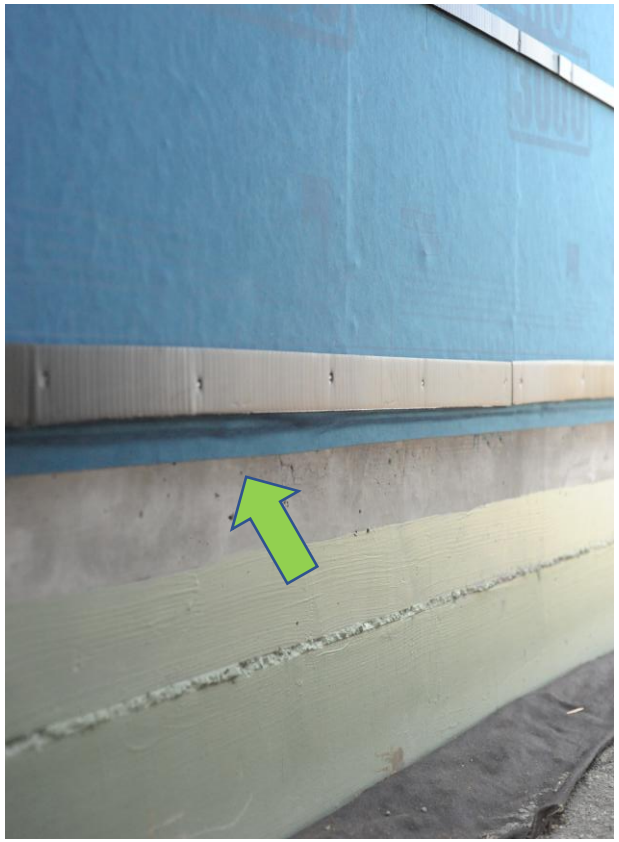


Many manufactures offer a suite of chemically compatible liquid membranes, sheet membranes, tapes, and sealants for air-tight construction.

Wall to Foundation Air-tight Connection

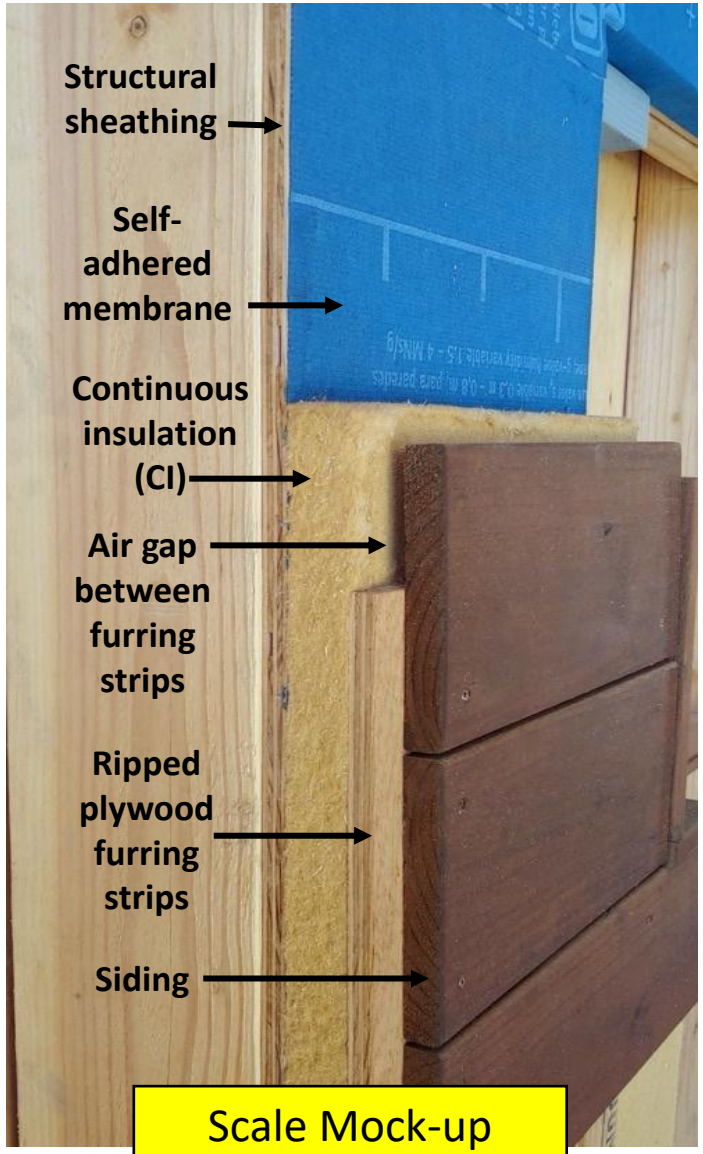
Specialized adhesive is applied via a convenient roll. It creates a permanent flexible connection to concrete.

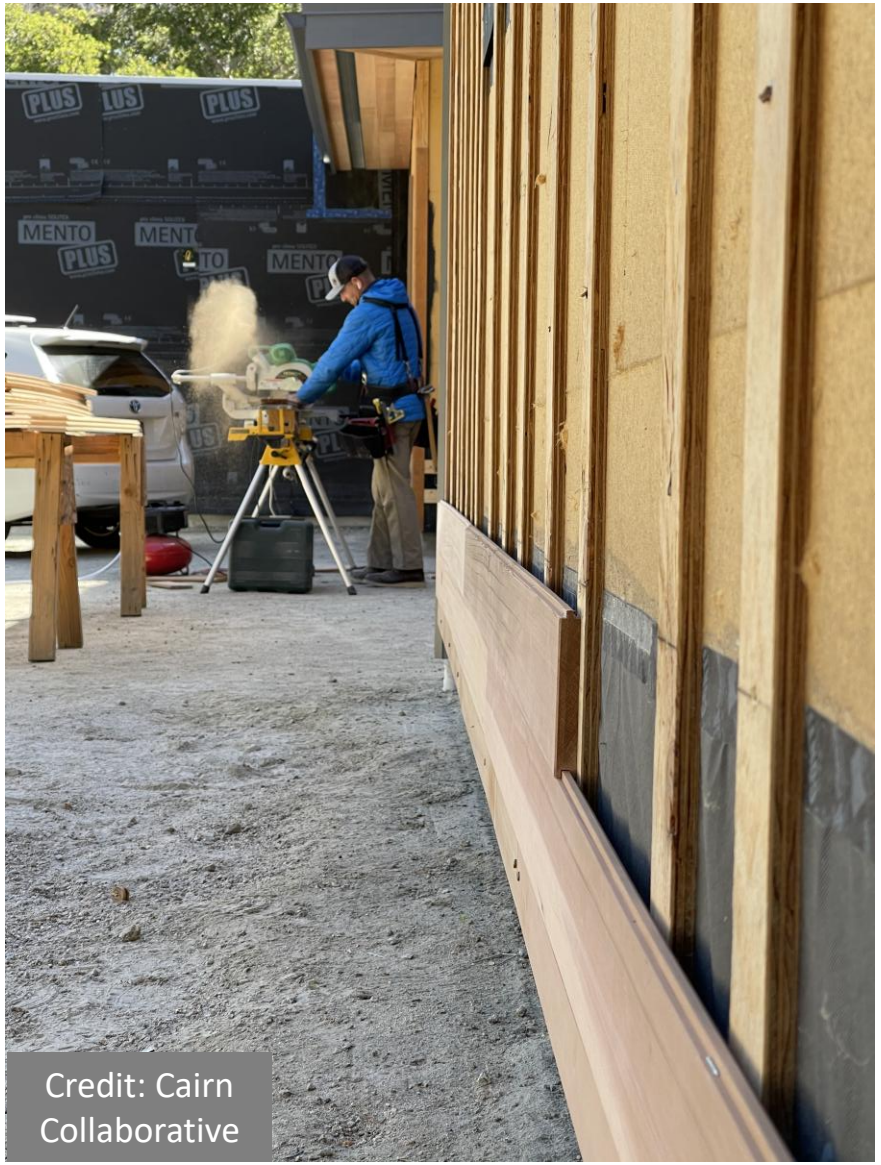
Membrane is sealed to foundation, below the structural sheathing and sill plate. Special attention to detail at all corners and joints is important.



Walls, Insulation, and Rainscreens

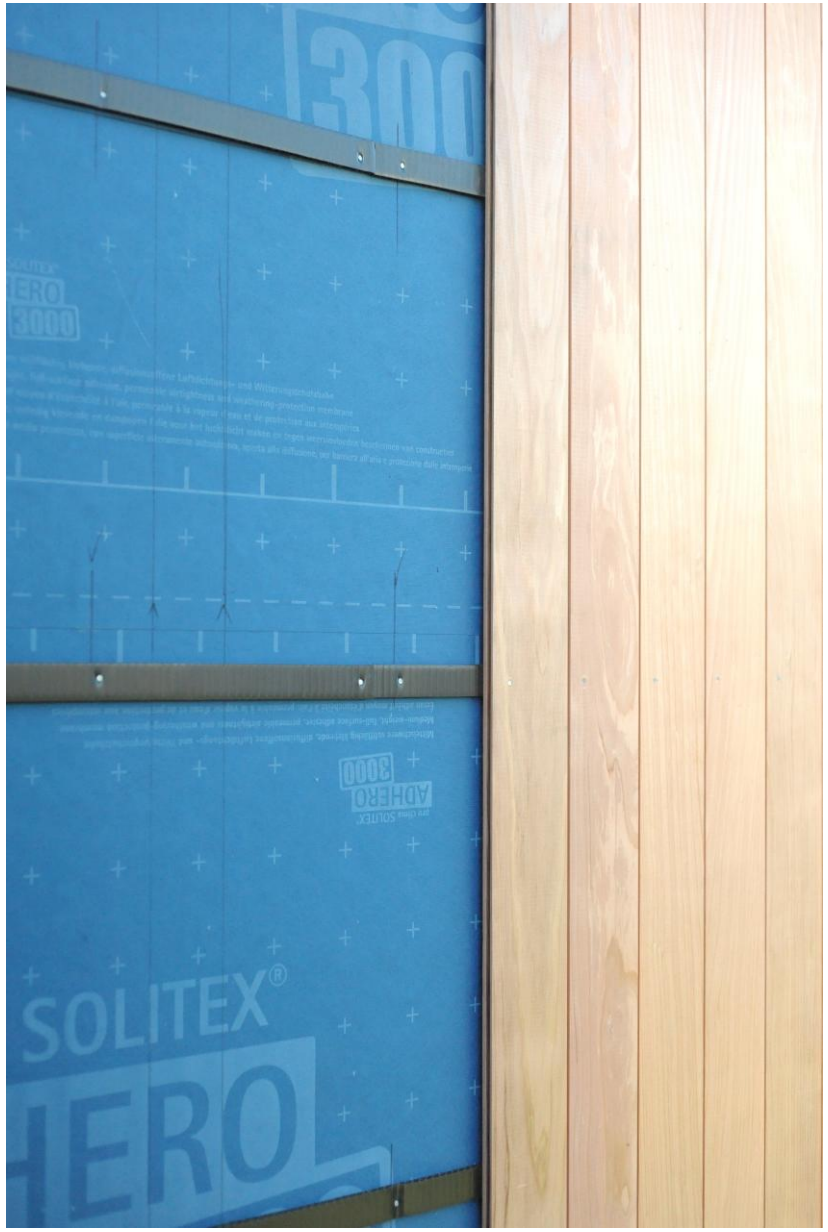
Rainscreen Wall Assembly with Exterior Insulation





Think Layers… Rainscreen allow drainage if/when water gets on the wall. Allows for faster drying.

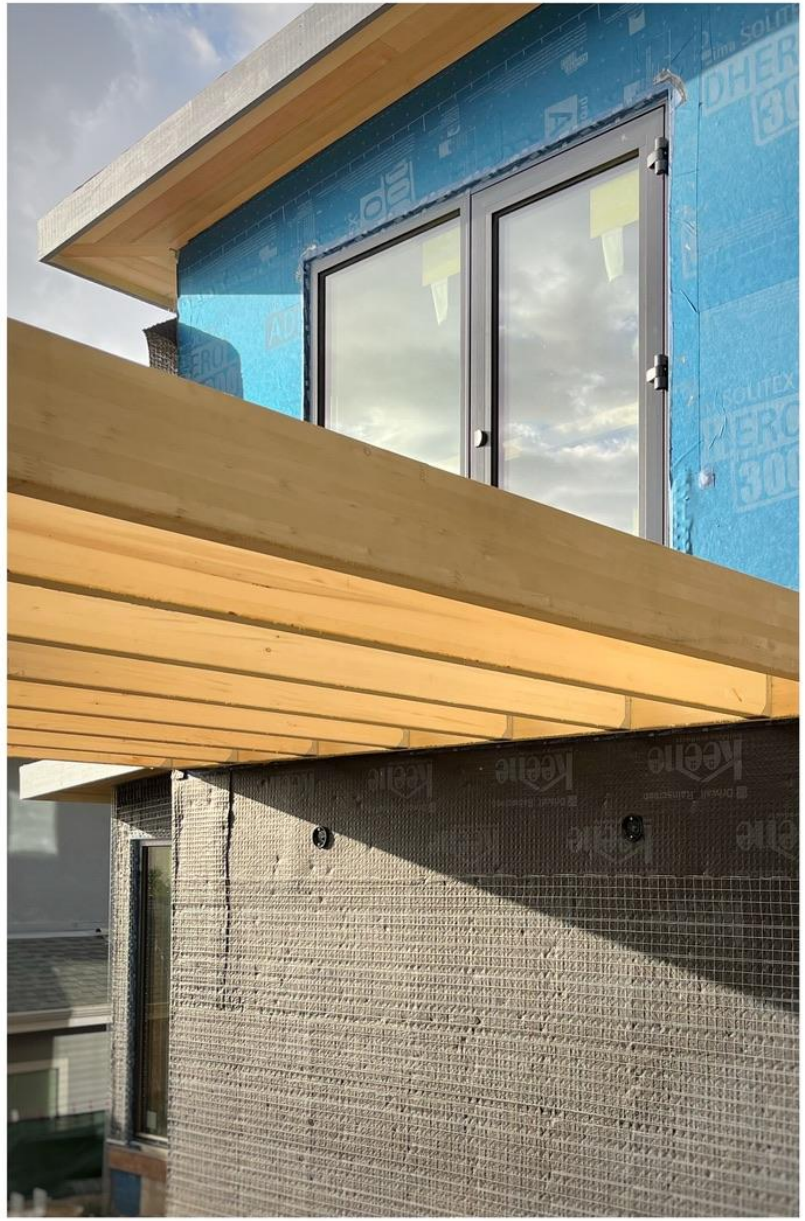
Rainscreen Assembly – Prep for Vertical Siding



Rainscreen Assembly – Prep for Horizontal Siding

Rainscreen Assembly – Prep for Stucco Siding over Exterior Insulation

Rainscreen Assembly – Prep for Stucco Siding w/out Ext. Insulation



Window Detailing with Exterior Insulation

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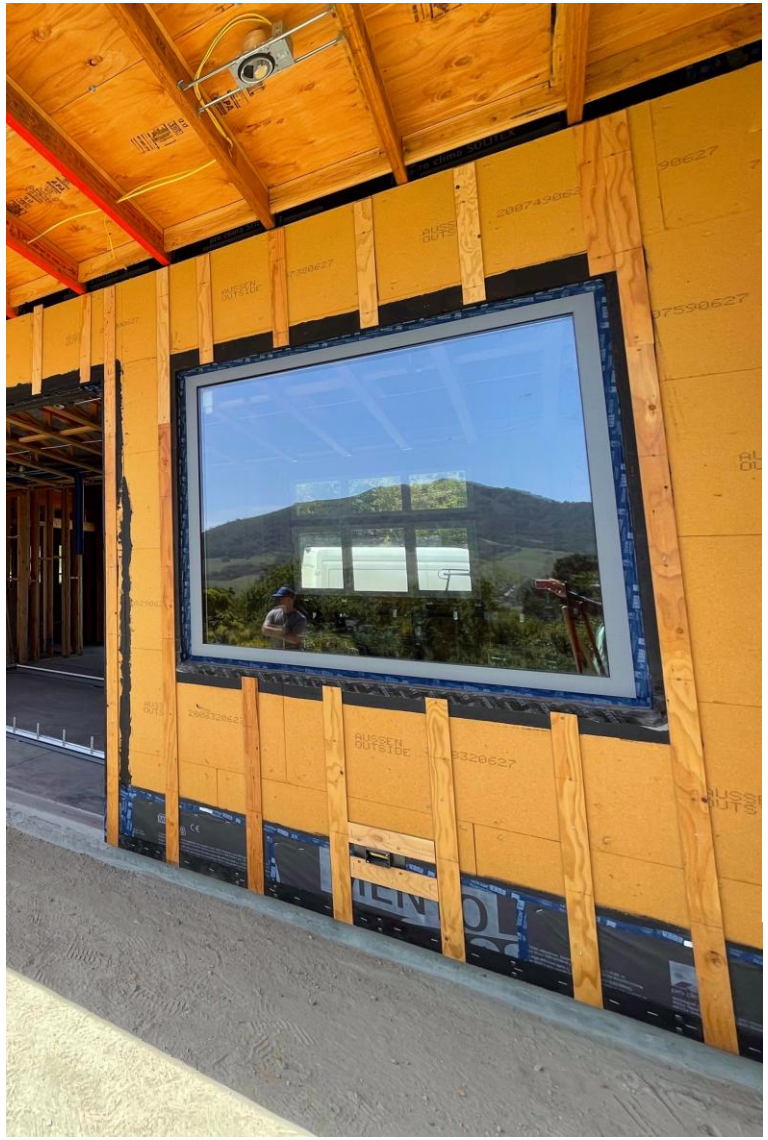
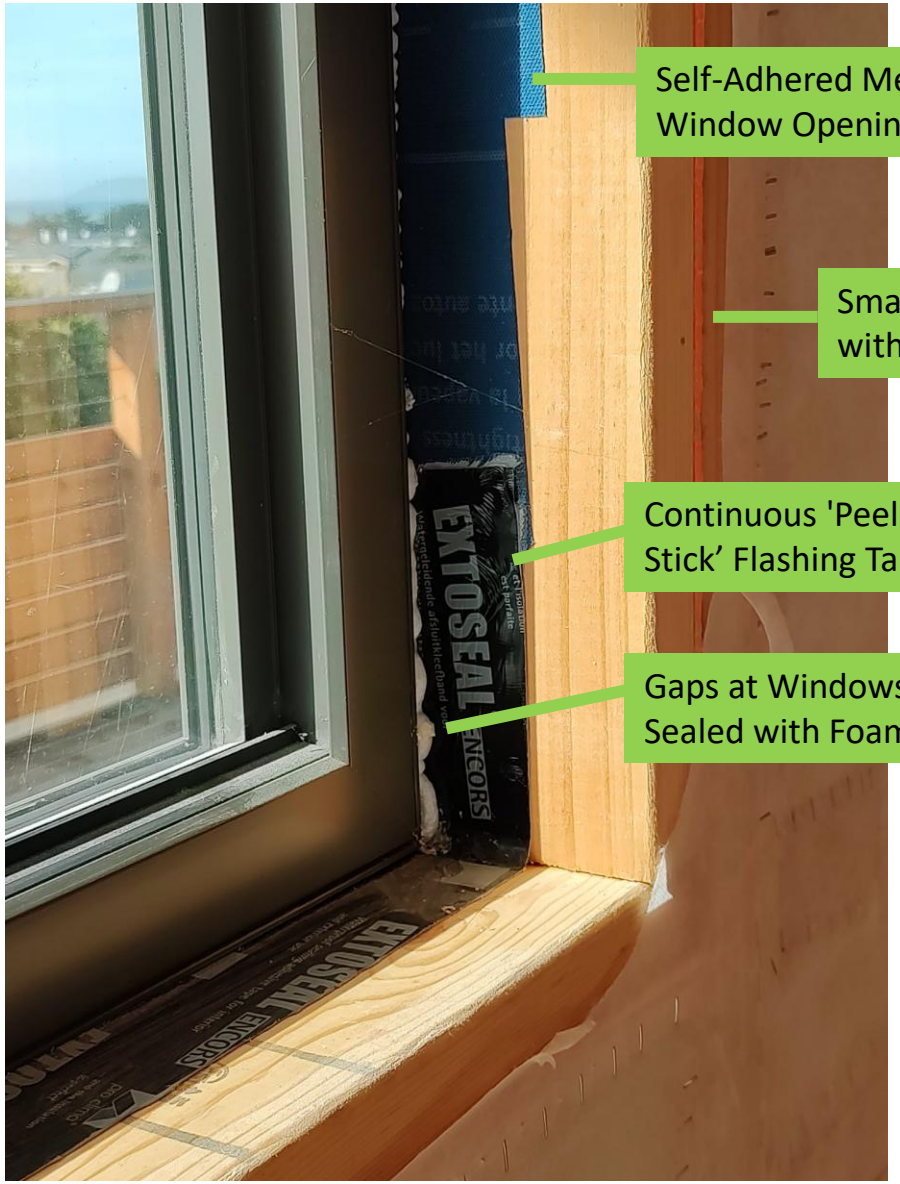


Air-Sealing at Windows without Exterior Insulation



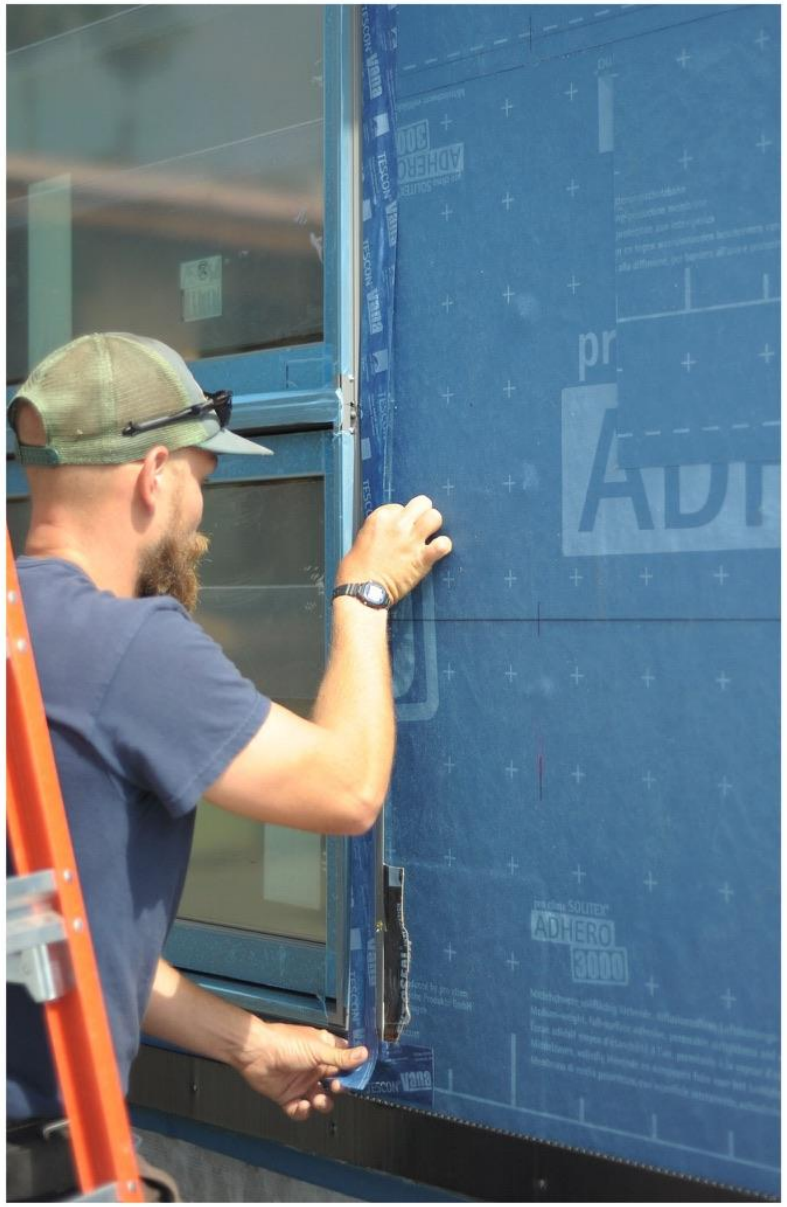
Self-Adhered Membrane Wrapped into Window Opening

Small Gaps – Air Sealed with Fire-Rated Foam

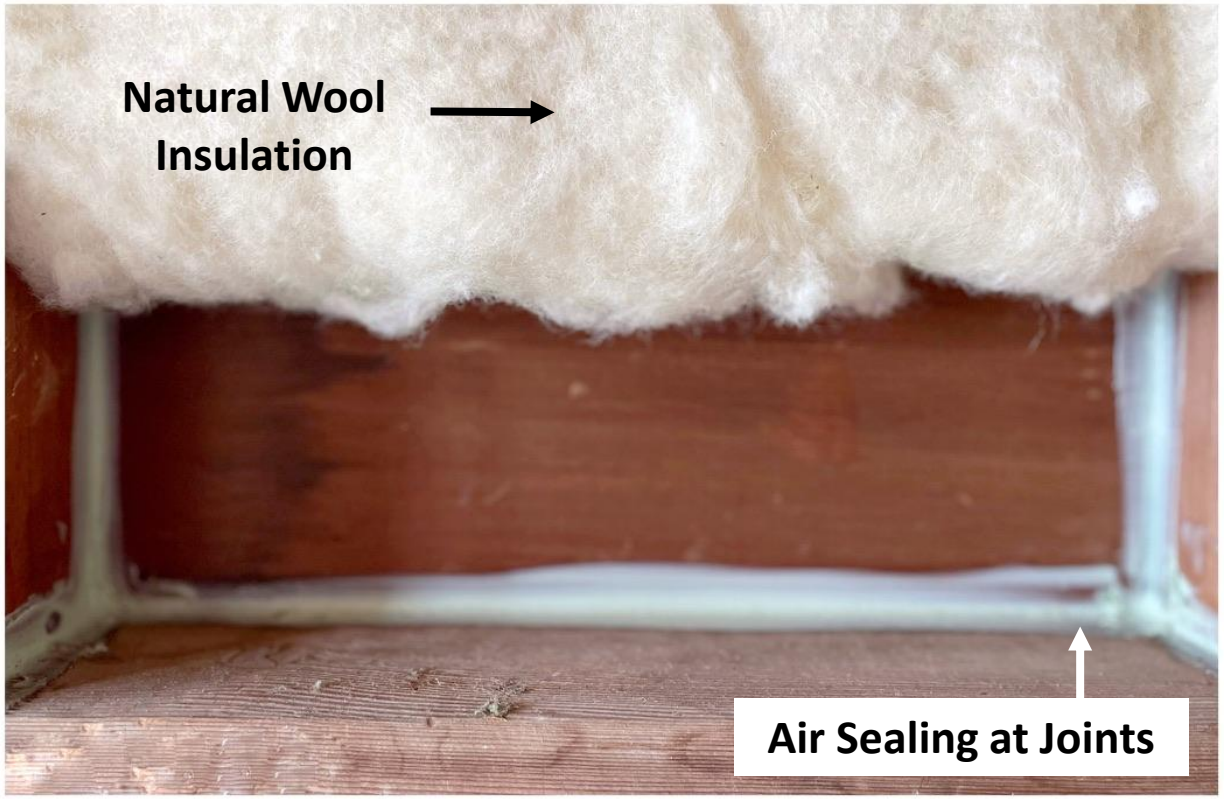
Continuous 'Peel and Stick' Flashing Tape

Gaps at Windows Air Sealed with Foam

Air-Sealing at Windows without Exterior Insulation



Cavity Insulation Considerations



- Product Types
- Installation
- Availability
- Cost Factor
- Health Factors
- Fire/Combustion

QII – Insulation Installation and Electrical Wiring

CF2R-ENV-03-E Mandatory and Part of QII

INSULATION INSTALLATION

CALIFORNIA ENERGY COMMISSION

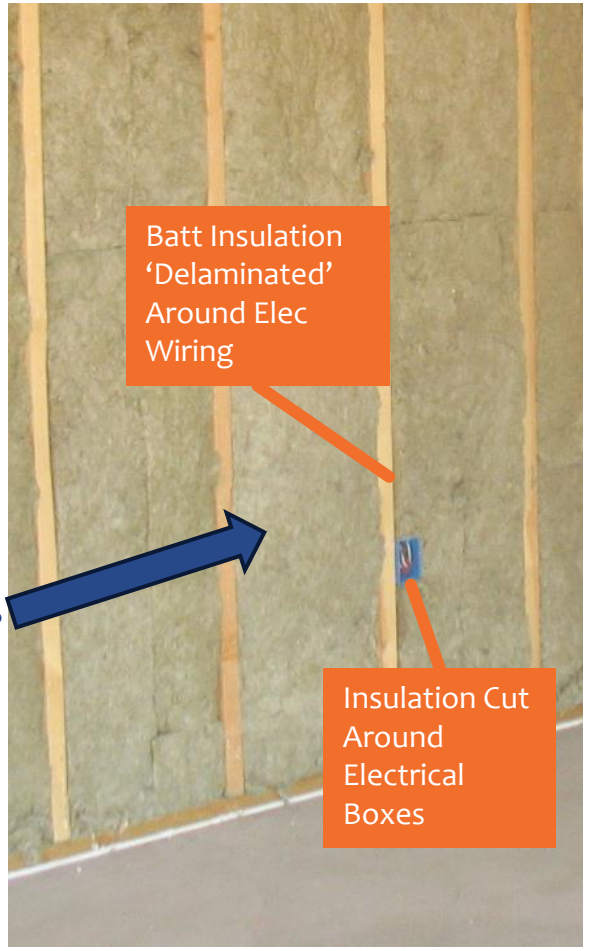
CEC-CF2R-ENV-03-E

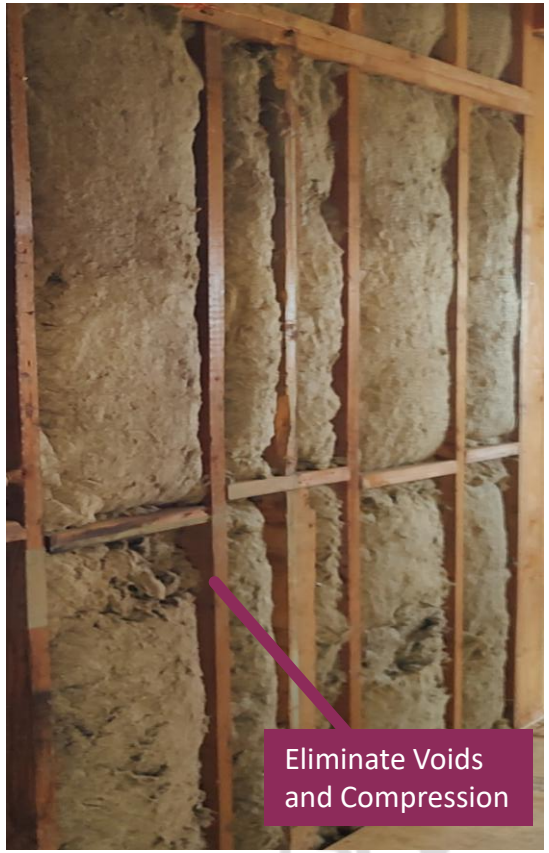
H. Installed Insulation

Field	Field Description
01	Installed insulation R-values are the same or greater than listed on the CF1R.
02	No gaps or voids between the insulation and framing.
03	No gaps between the sides or ends of batt insulation.
04	Loose-fill insulation must be installed to the minimum installed weight per square foot (density) of the manufacturer's cut sheet for the proposed R-value.
05	Batt insulation is not compressed (no stuffing of the insulation into the cavity) and is installed to its full thickness.
06	Insulation is cut around obstructions such as electrical boxes.
07	Batt insulation is delaminated around all plumbing and electrical lines in ceilings, walls, and floors.
08	Band joists are insulated to the same R-value as the wall.
09	In all narrow cavities the insulation shall be cut to fit or filled with expanding foam.
10	Insulation was installed per manufacturer instructions.

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.

PASS on the Left, FAIL on the Right.





Insulation was compressed at the framing members.

QII – Made Easy with Blown-in Products

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CALIFORNIA ENERGY COMMISSION

CEC-CF2R-ENV-03-E

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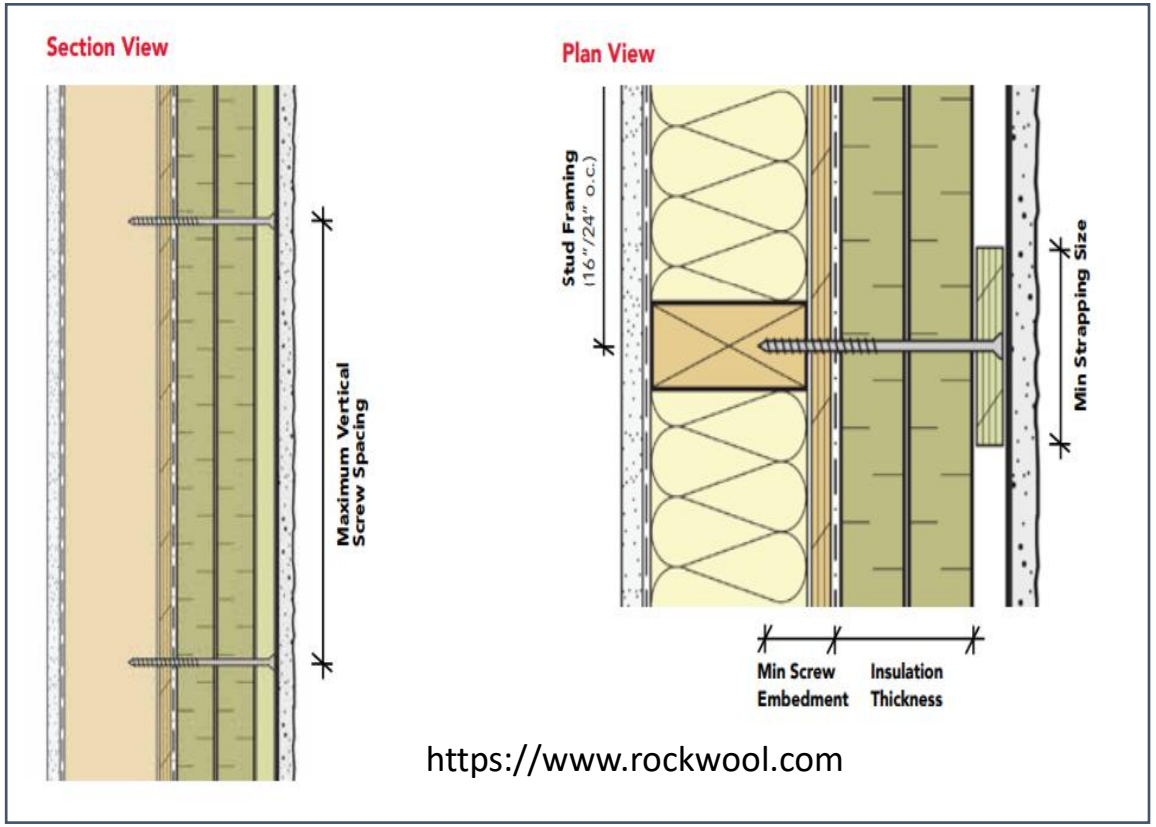
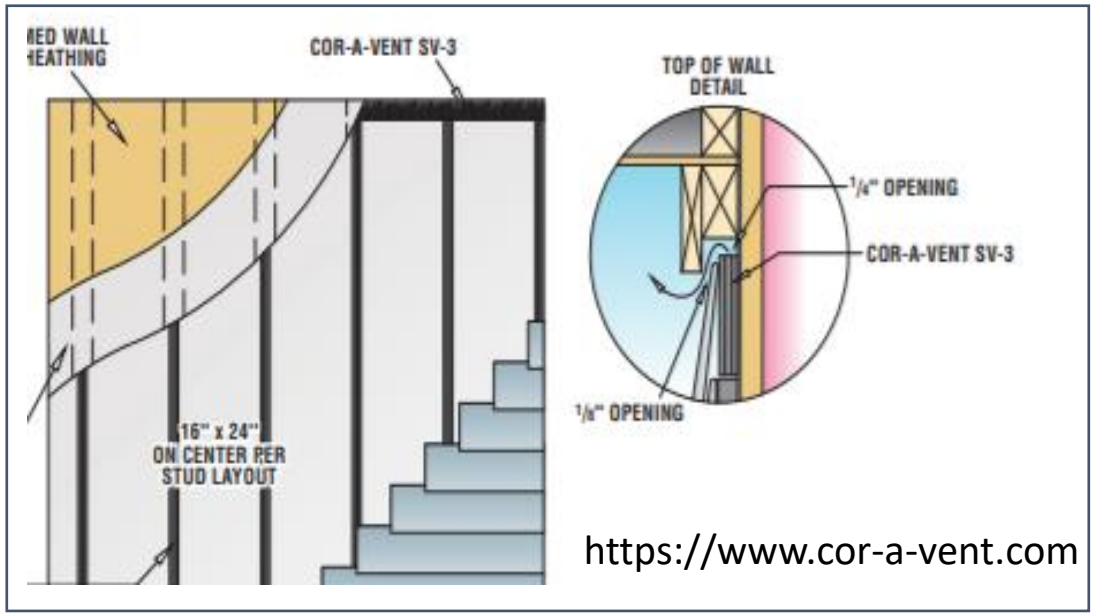
I. Wall Insulation

Additional Rainscreen Wall Assembly Resources

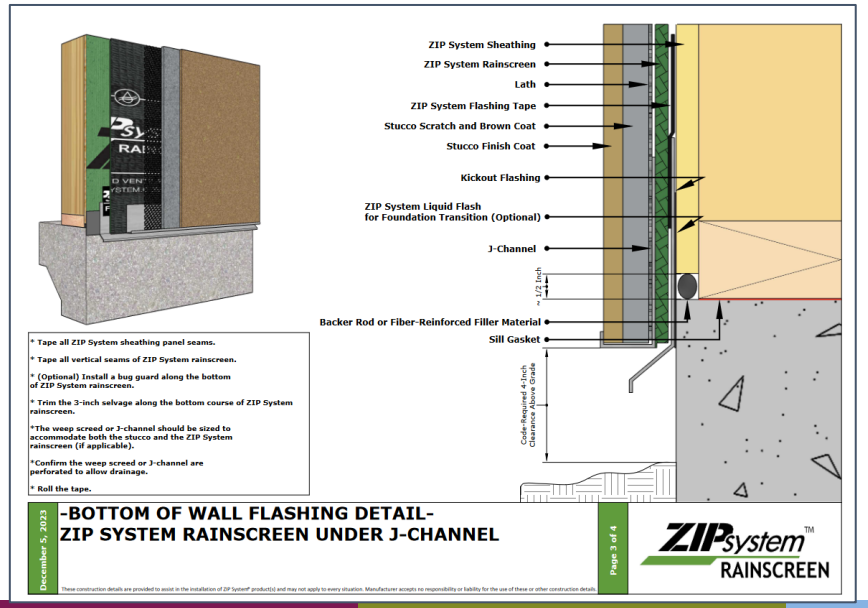
Manufactures want to sell product.
Manufactures offer detailing resources.



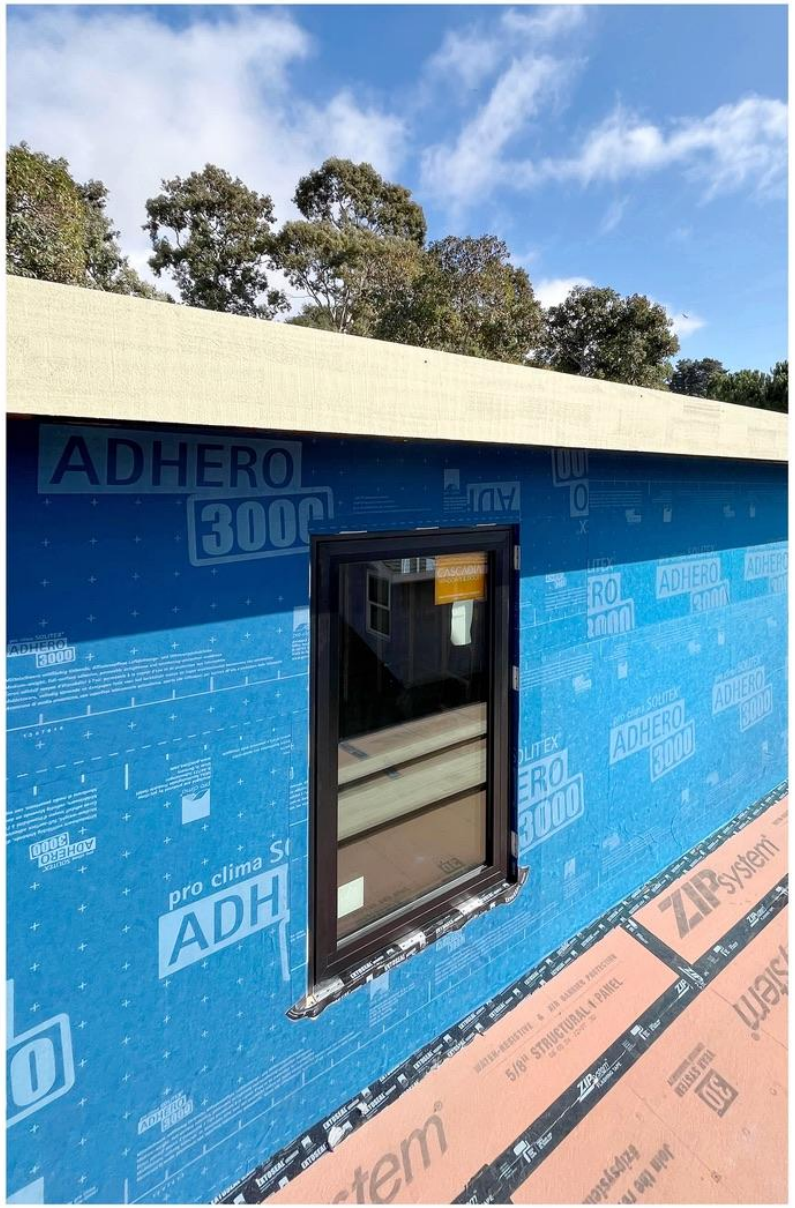
https://www.rockwool.com



https://www.cor-a-vent.com



‘Ideal World’ – Air-Barrier from the Exterior



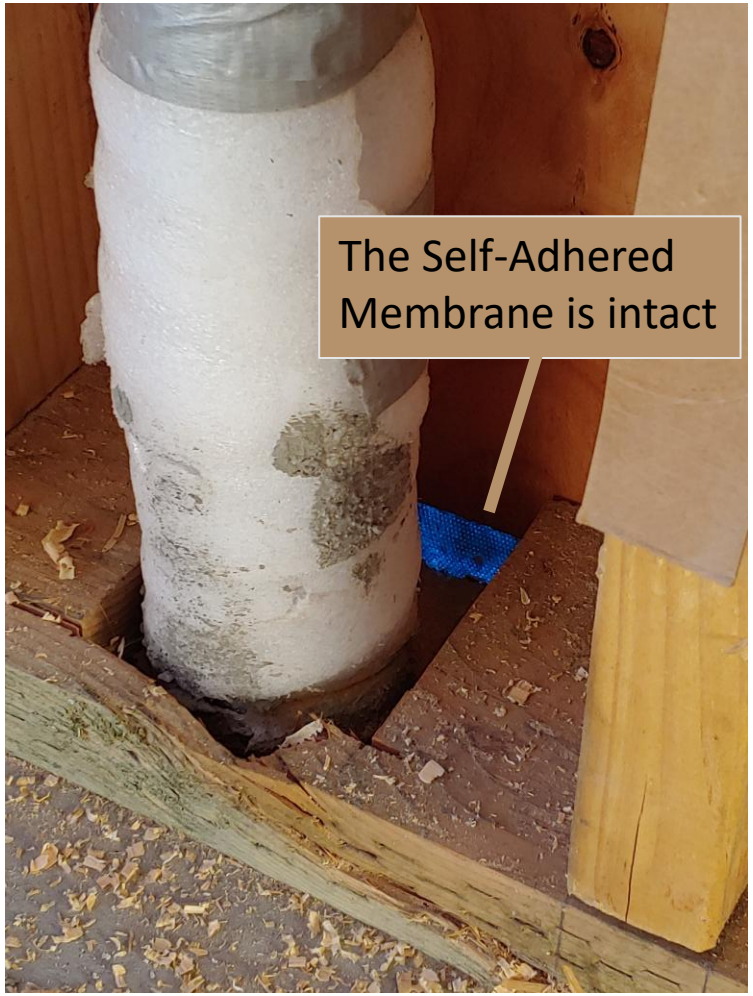
Remodel –Air Barrier from the Interior

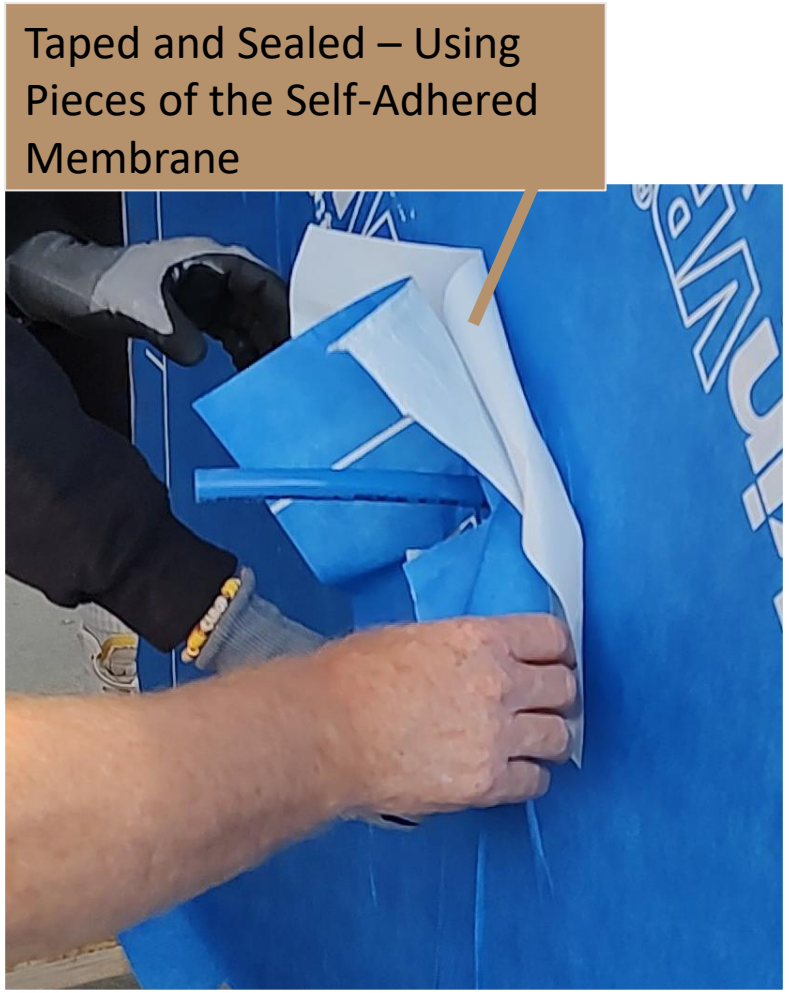
1

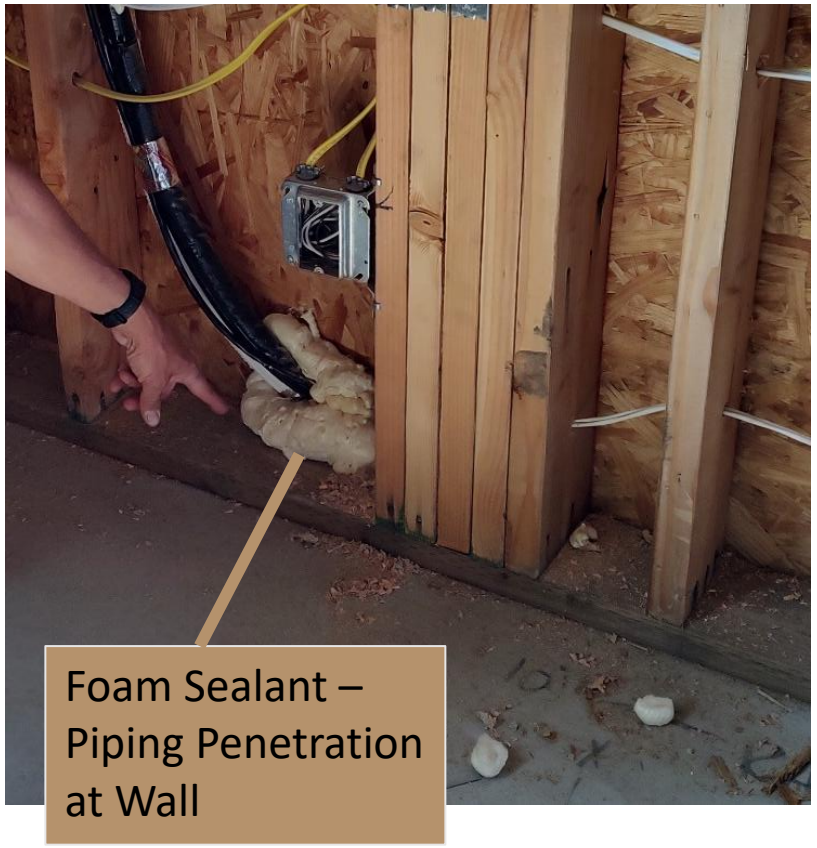
2

3

Details Matter - Openings and Penetrations in Wall Assemblies



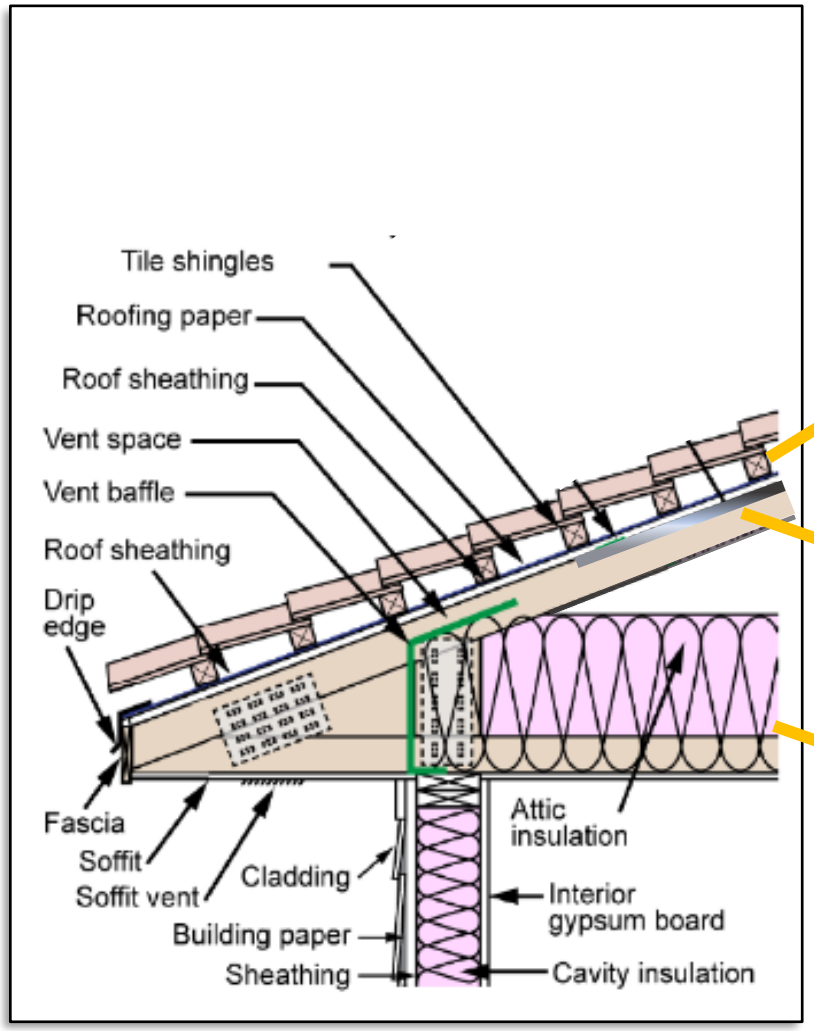




Roofs/Ceilings and Attics

Energy Code… Starting Point

This is the Baseline for the Performance Method – Assumes Ducts in a Vented Attic



Modified CEC Image

Note: Applies to Climate Zones (CZ) 1-3 and 5-7

Footnote 1: Air-space between the *Roofing* and the *Roof-Deck* (aka Sheathing)

Radiant Barrier, per CZ

R-30 or R-38, per CZ Prescriptive Ceiling Insulation

Energy Code… Starting Point

This is the Baseline for the Performance Method – Assumes Ducts in a Vented Attic

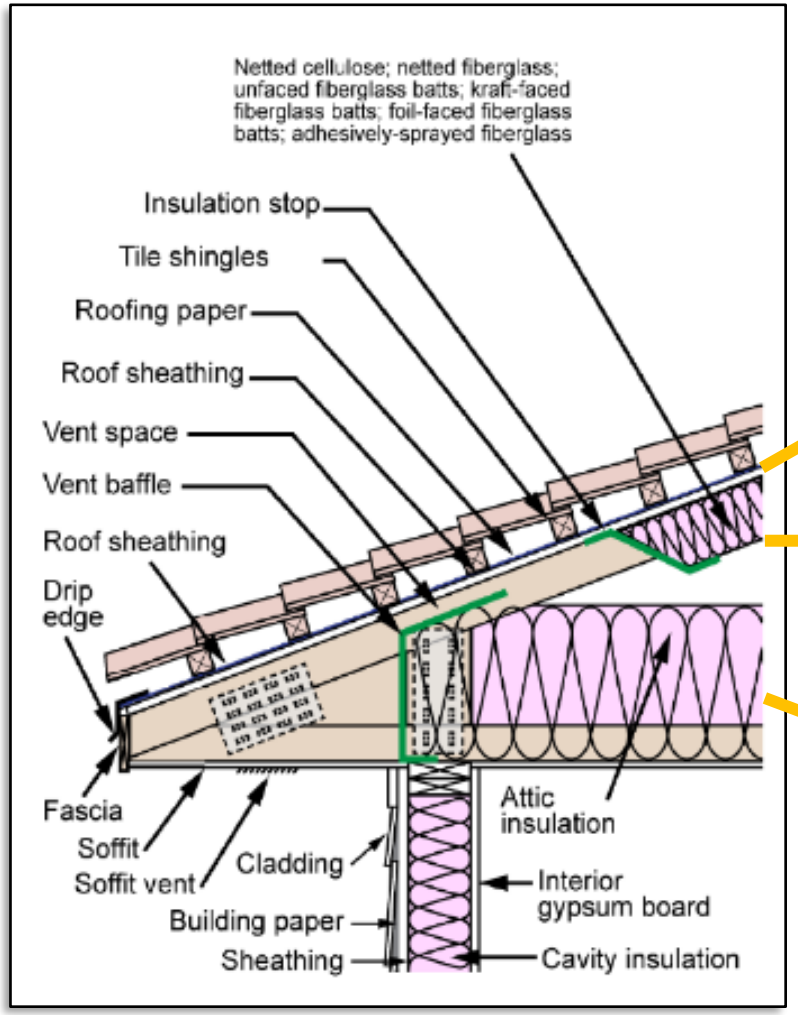


Image credit: CEC

Note: Applies to Climate Zones 4 and 8-16

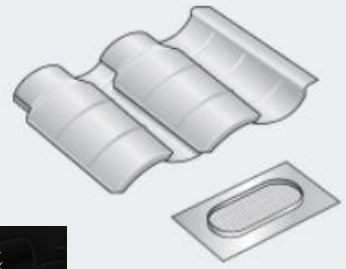
Footnote 1: Air-space between the *Roofing* and the *Roof-Deck* (aka Roof Sheathing)

R-19 Prescriptive Below Roof-Deck Insulation

R-38 Prescriptive Ceiling Insulation

Better Ways to Vent Attics

Baffled and Protected Screened Openings
- Screen Openings –min 1/8” dia
- Wire Mesh –1/16” min wire thickness



O’HAGIN

FIRESTORM BUILDING PRODUCTS

When wildfires come near and reach critical temperature, the intumescent coating on the matrix structure expands, creating a "firewall."

VULCAN VENT FIRE & EMBER SAFE VENTS

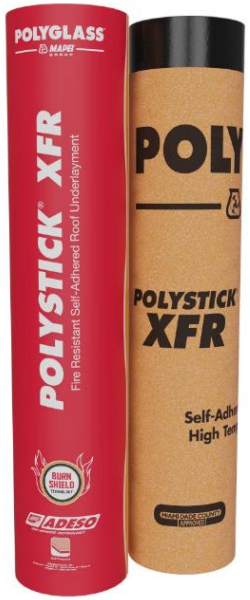
Use Fire-Rated Manufacture’s Recommended Sealant and Adhesives

3C REN

Fire-Resistant Roofing Product in Practice

POLYGLASS
MAPEI GROUP
POLYGLASS U.S.A., INC. > TECHNOLOGY > ADESO®

Polystick® XFR



Fire-resistant self-adhered underlayment

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Cathedral Roofs and Conditioned Attics…

Spray Foam at Cathedral Roof Framing

Blown-in Insulation at Underside of Roof/Ceiling

Unvented Rafter Roof – Batt under Spray Foam

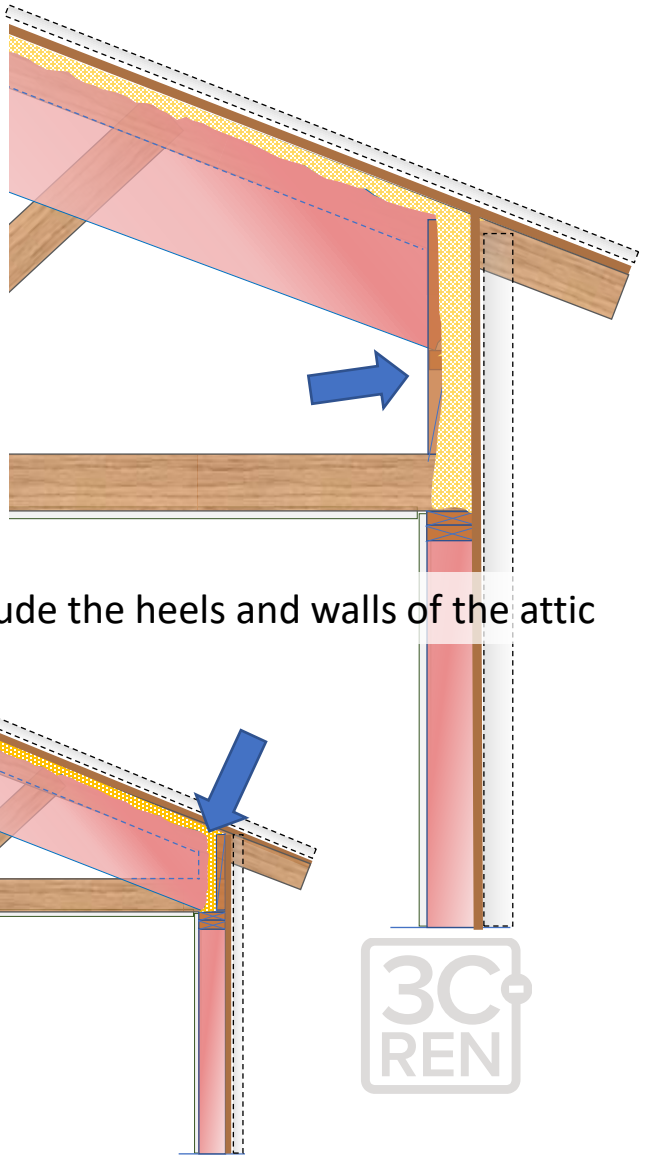
Excerpt from form CEC-CF2R-ENV-21-QII-H:

A. Air Barrier Materials

Note: SPF insulation is an acceptable air barrier and sealant when installed to a minimum thickness of 2 inches for closed cell and 5.5 inches for open cell, except where not allowed by manufacturer (e.g., flues, vents, can lights, etc.).

2” Closed Cell Spray Foam is adhered to underside of roof deck.

Remaining cavity is filled with Batt Insulation. (Blown-in insulation would also be acceptable.)



Include the heels and walls of the attic

Applied Eaves, and Vented ‘Over Roof’

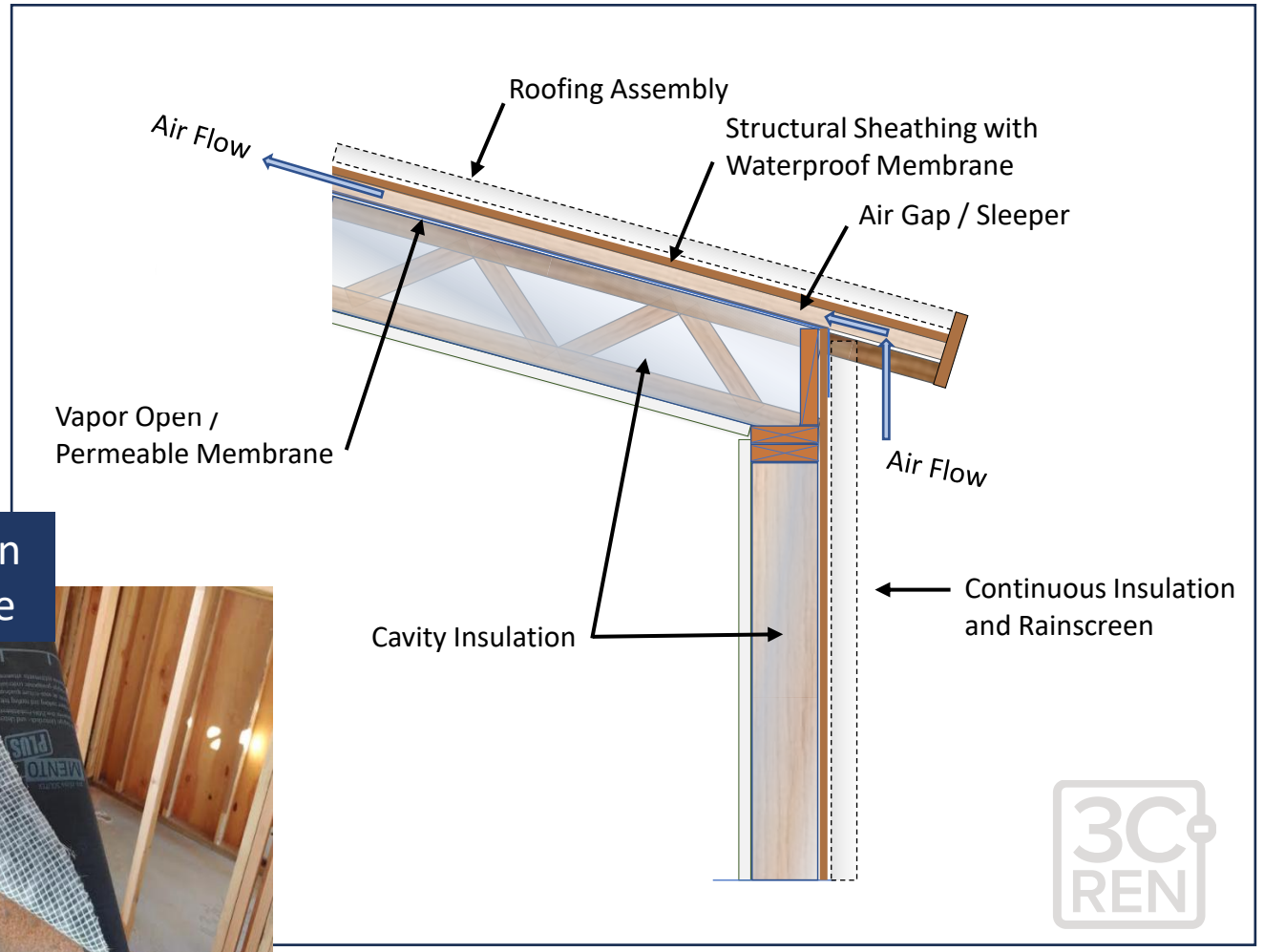
A Vented Rafter Roof Assembly with a ‘Smart’ Membrane

Run ‘sleepers’ along top of trusses or 2x rafters

Photo/Project Credit: Cairn Collaborative

Looking from below before insulation

Vapor open membrane



Wall to Roof Sequencing and Continuous Air Barrier

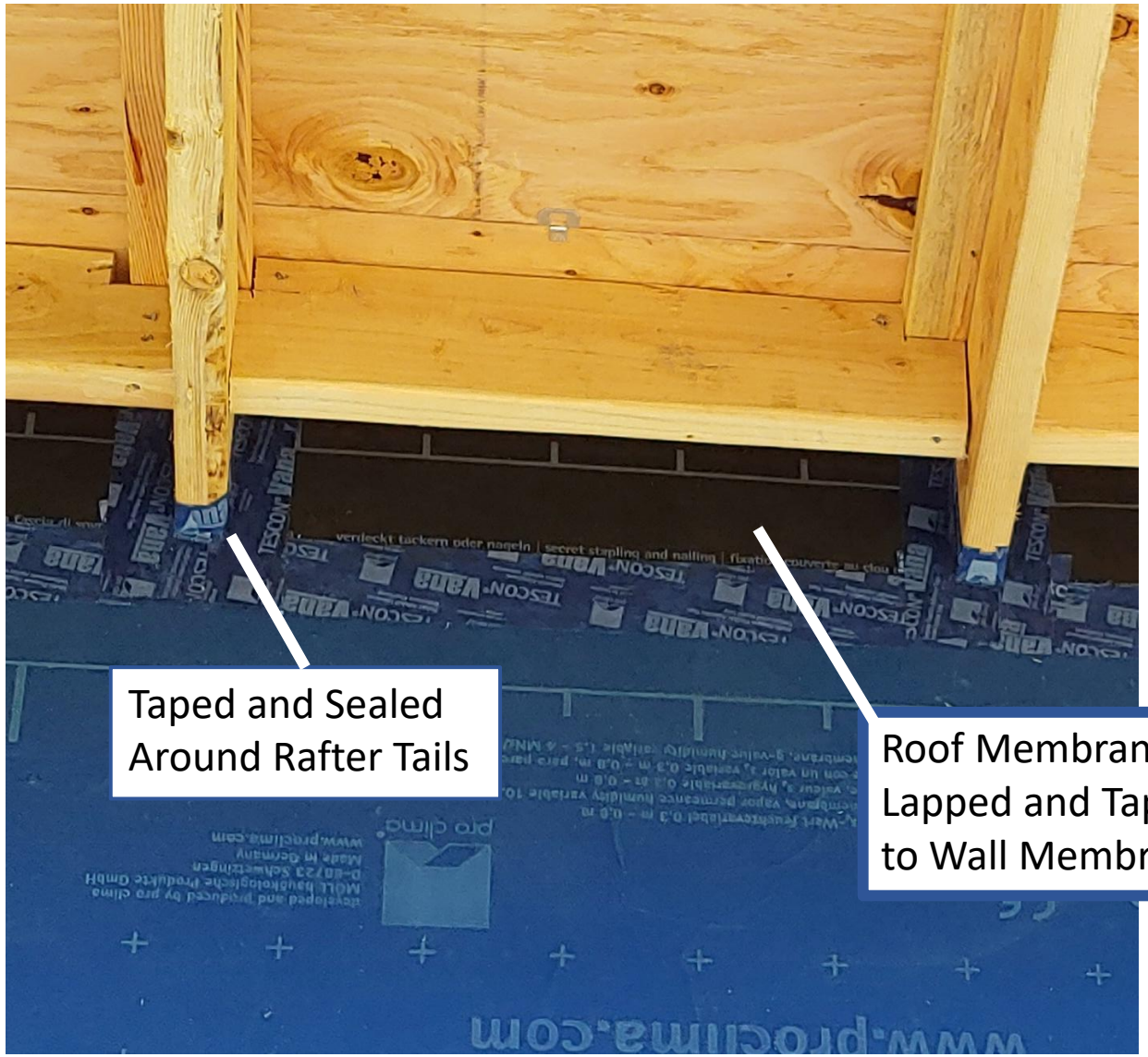
Problems Are Opportunities For Solutions

No such thing as an original idea. Architects and Builders can unite, borrow from each other, borrow from others, and build on those ideas. Come up with something. Build a mock-up. Ask questions. Do your job.

(Start with YouTube or Instagram)

(Seriously)

Rafter Tails – When Extended Through Wall



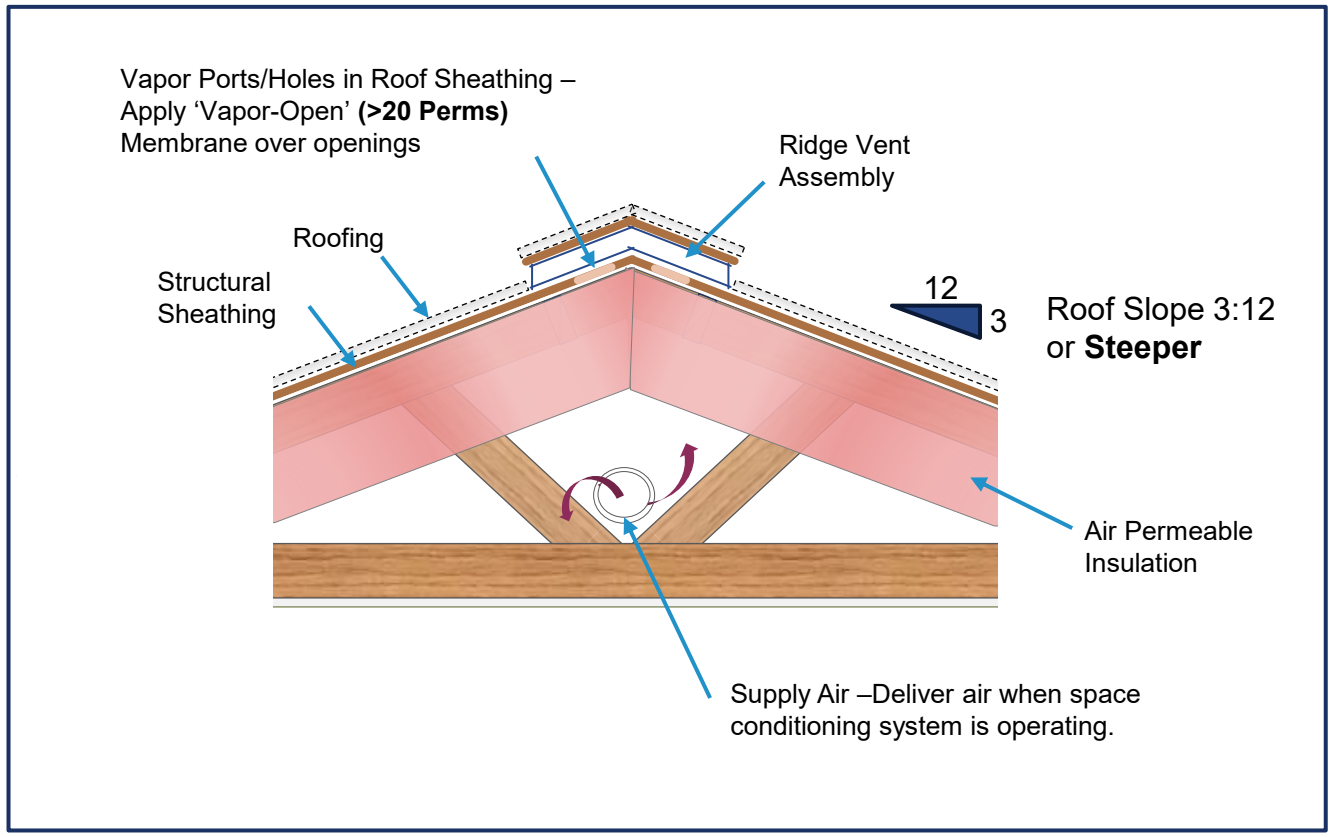
Larger Overhang Design

Rafter Tails – When Extended Through Wall

Common Overhang Design

Unvented Attic with Air-Permeable Insulation at Roof

Key Takeaway: Per Building Code part 2.5, this assembly requires a Vapor Diffusion Port and Supply Air from Space Conditioning System



Semi-Conditioned Un-Vented Attic with Vapor Diffusion Port at Roof Ridge

R806.5, 5.2.2. Vapor Port Area

- Net Free Area of Ridge Diffusion Ports/Holes = 1:600 of Ceiling Area*
- **Example**: 1000 sq ft ceiling requires min 1.67 sf ft of opening or 240 sq inches of net free area. (50) 2.5" dia holes = 245 sq inches.

R806.5, 5.2.10. Supply Air CFM

- Supply Air = 50 cfm per 1000 sq ft of Ceiling Area
- **Rule of thumb**: 6" dia duct per each 1000 sq ft of celling area.

*Proposed Updated Code Language and 1:150 of Ceiling Area.

Air-tight ‘Hot Spots’ – Wire, Conduit, Small Piping Running into the Attic

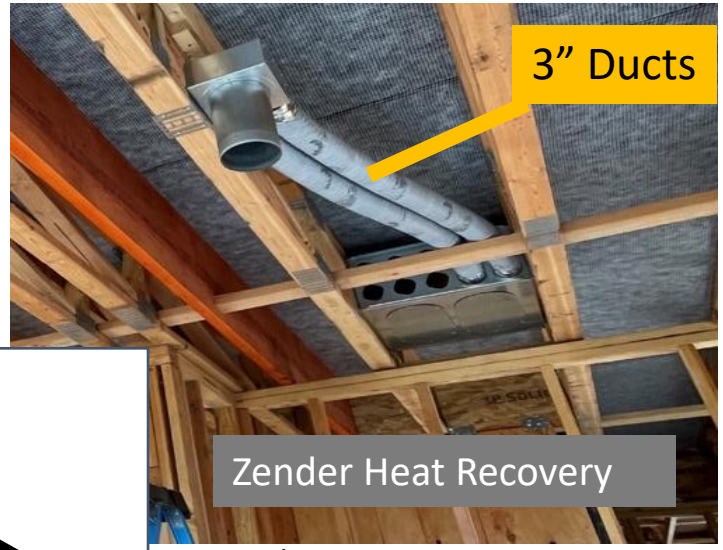
Note:
It’s more effective to seal small individual penetrations rather than one large opening with many wires/piping running through it.

IAQ and Wrap Up

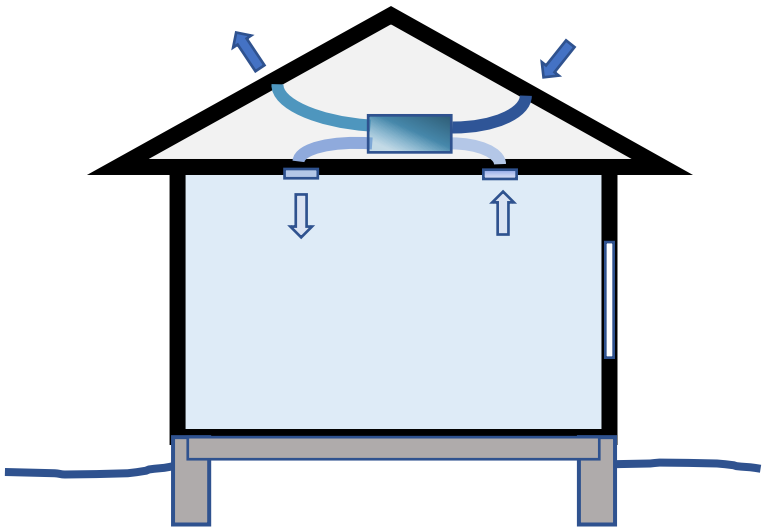
Balanced Ventilation with Heat Recovery (HRV)

Two Basic Types:

- Whole House Systems
- ‘Spot’ HRV/ERVs



Image/Project: Cairn Collaborative



ERV/HRV Balanced Ventilation with fan efficacy of ≤1.0 W/cfm

- Performance Credit Available
- Must be HVI –Certified Products Directory listed for credit (HVI.org)

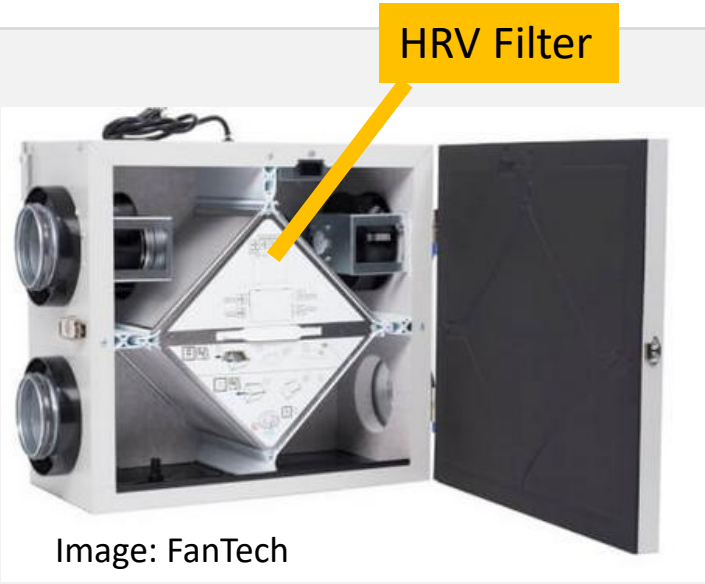
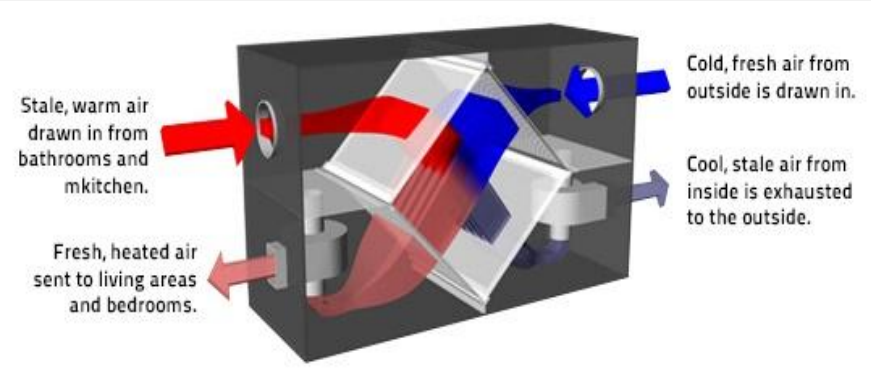
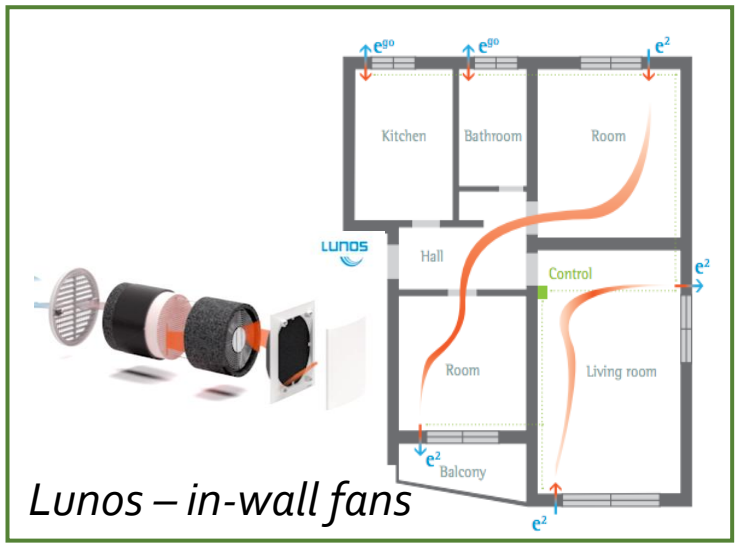


Image: FanTech

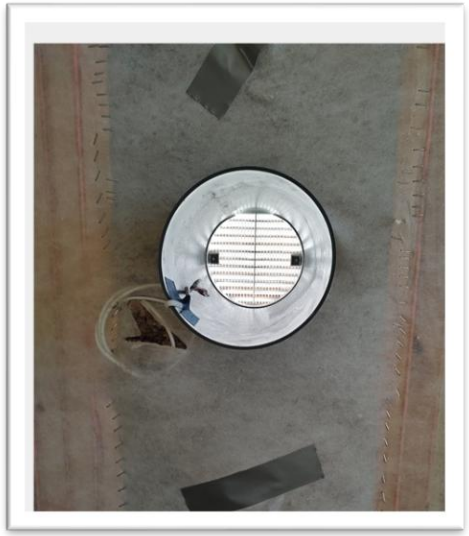


Conceptual Diagram of Heat Recovery

Lunos – Distributed Room/Spot ERV



Lunos – in-wall fans



What am I, as a builder, am I aiming for?

- Price
- Warranty
- Availability
- Reliability of the Vendor

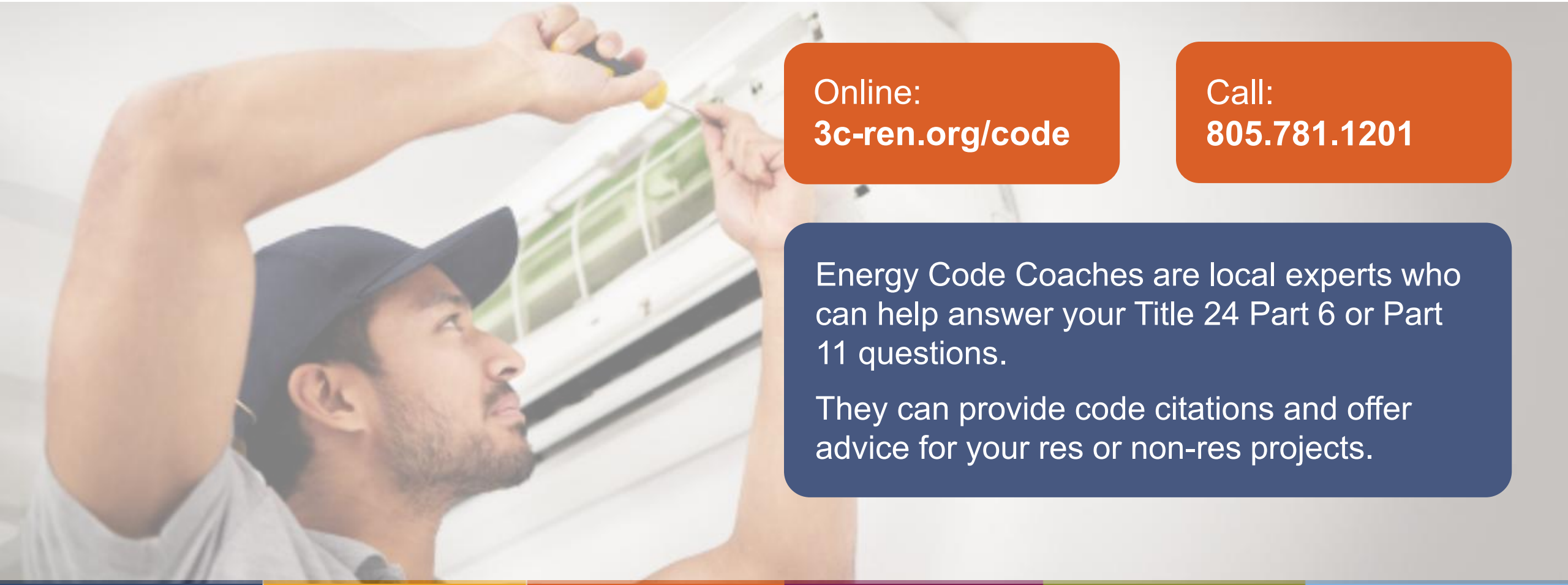
…etc, but also

- Coordination of Trades and Sequencing
- Ease of Construction

…Energy Efficiency ~~Shouldn't be Hard~~ should be easy!

Questions about Title 24?

3C-REN offers a *free* Code Coach Service



Online:
3c-ren.org/code

Call:
805.781.1201

Energy Code Coaches are local experts who can help answer your Title 24 Part 6 or Part 11 questions.

They can provide code citations and offer advice for your res or non-res projects.

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Coming to your inbox soon

- Slides & Recording from today's talk

Upcoming courses:

- The Practical Guide to All-Electric Res Buildings (Part 1) (5/28)
- Reducing Carbon Emissions from MEP Systems (6/09)
- The Practical Guide to All-Electric Res Buildings (Part 2) (6/11)
- Natural Insulation for Low Carbon Builds Energy (6/16)

Any questions?

- Contact chloe.swick@venturacounty.gov