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

** Please note: Additional clarifications and corrections were added to slide 25 following the recorded live presentation.

Ask the Experts: *Enclosures*

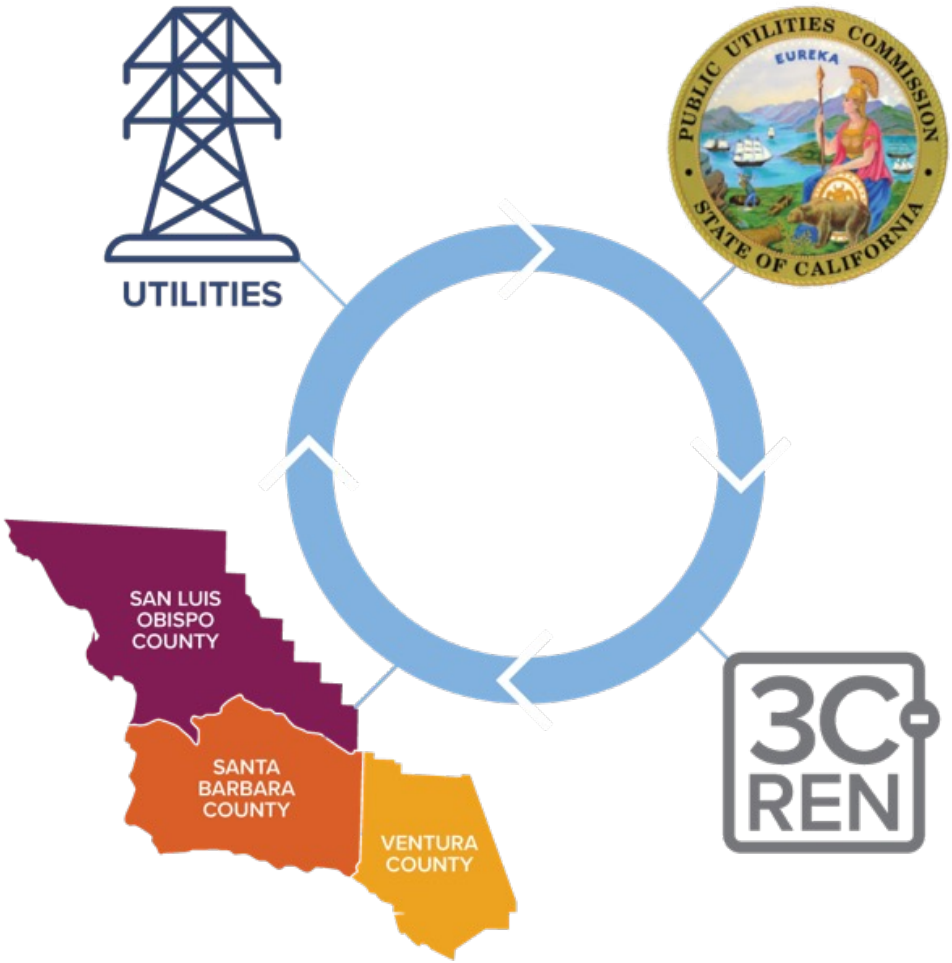
Judy Rachel – Home Performance Pro

8/26/2025

Before We Begin

Here are some quick reminders:

- Did you 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.
- Session is being **recorded** and posted to 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
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3c-ren.org/assurance

Enclosures Office Hour

Framework for thinking about enclosure issues

Presenter – Judy Rachel

1. Home Performance Technician
2. Contractor Field Mentor
3. Perform load calculations and HVAC system design
4. Field Research/Building Performance Testing
5. Diagnostic testing of existing HVAC systems
6. Trainer for Home/High Performance Homes, ACCA load calculations, Healthy Homes, use of diagnostic test equipment, combustion safety, etc.

Enclosure Office Hour

- ***Role of the building enclosure***
- Driving forces of air, heat and moisture

Building Enclosure – An environmental separator

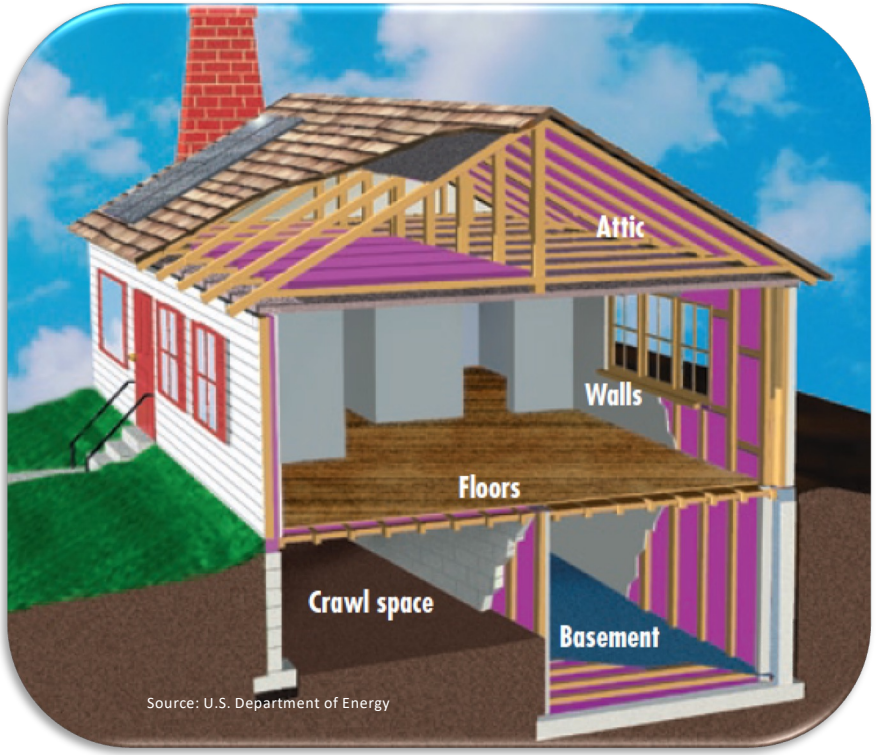
Image courtesy of Judy Rachel

The primary protection from the outdoor elements – wind, rain, snow, temperature changes and solar radiation.

The enclosure should maximize heat retention in winter and minimize heat gains in summer, thereby reducing heating and cooling needs creating the opportunity to provide a comfortable indoor environment.

Building Enclosure Control Layers

1. Water Control Layer
2. Air Control Layer
3. Vapor Control Layer
4. Thermal Control Layer



Enclosure Office Hour

- ✓ Role of the building enclosure
- ❑ ***Driving forces of air, heat and moisture***

Physics of Air Flow

Air Flow is dependent upon 2 variables:

1. A **hole** or a crack and its size

2. A **driving force** (**pressure difference**) across the hole (to push the air through the hole)

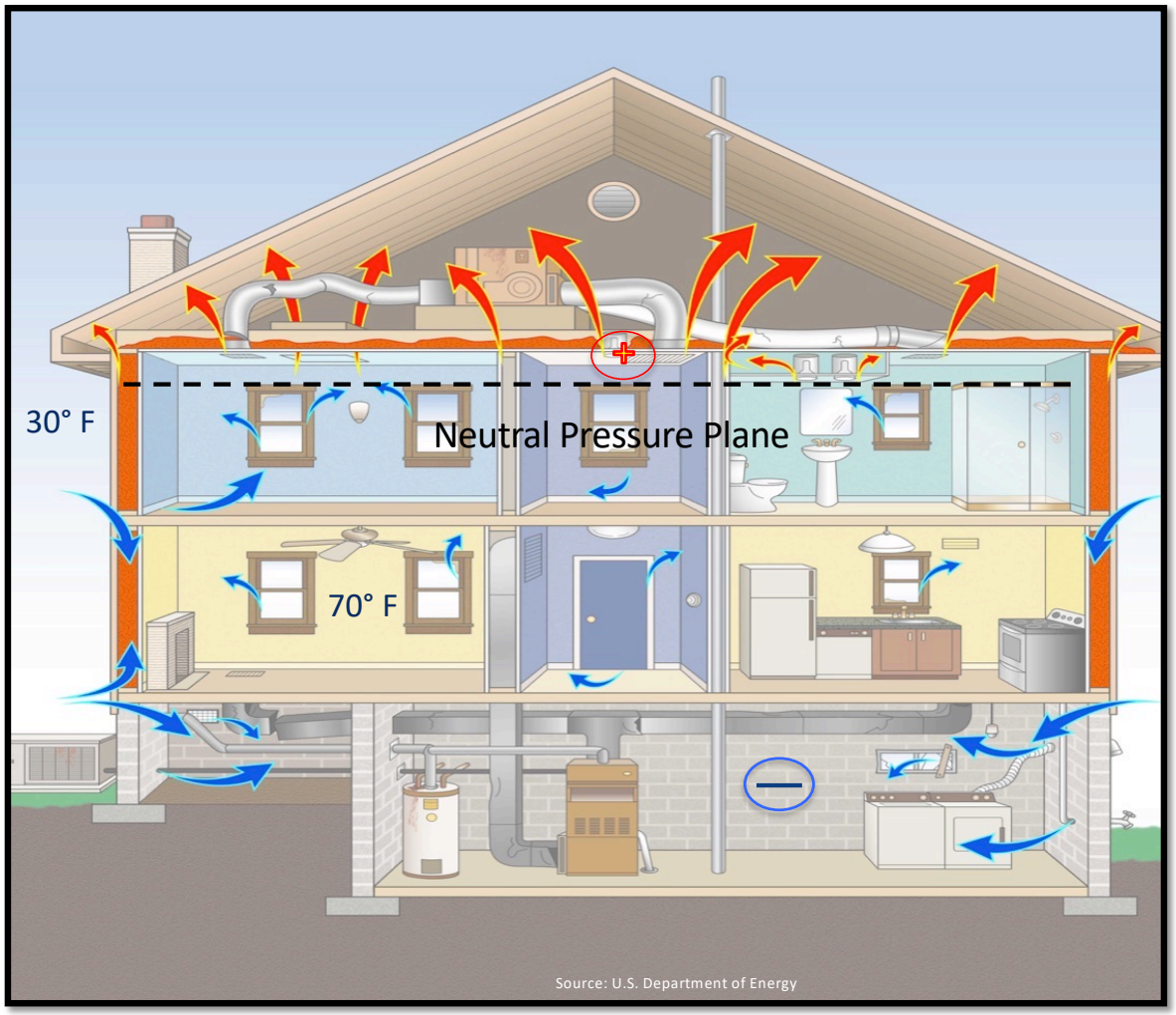
Natural and Mechanical

DRIVING FORCES

STACK EFFECT

The effect of air stratification within a building

- When it is cold outside warm buoyant indoor air rises and leaks out of holes at the top of the house
- Cold air then leaks in from leaks lower in the house (1 cfm in = 1 cfm out)
- The magnitude of this driving force depends upon:
  - the height of the home
  - the difference between the indoor and outdoor temperatures



WIND EFFECT

- Wind blowing against a wall creates a positive pressure area driving infiltration
- On the leeward side, negative pressure is created driving exfiltration of interior house air
- The taller the building the greater the wind's force against the home
- The pressure against the building increases as the distance from the ground increases

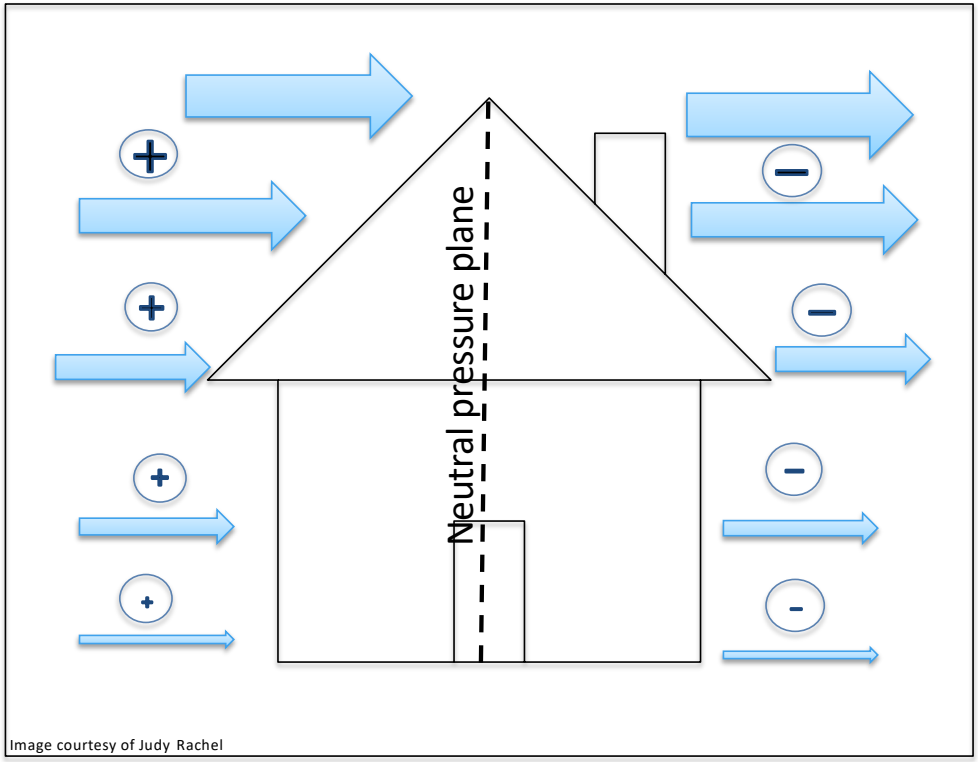


Image courtesy of Judy Rachel

FLUE EFFECT

Chimneys, vents and flues move air out of buildings inducing infiltration to make up for that exiting air

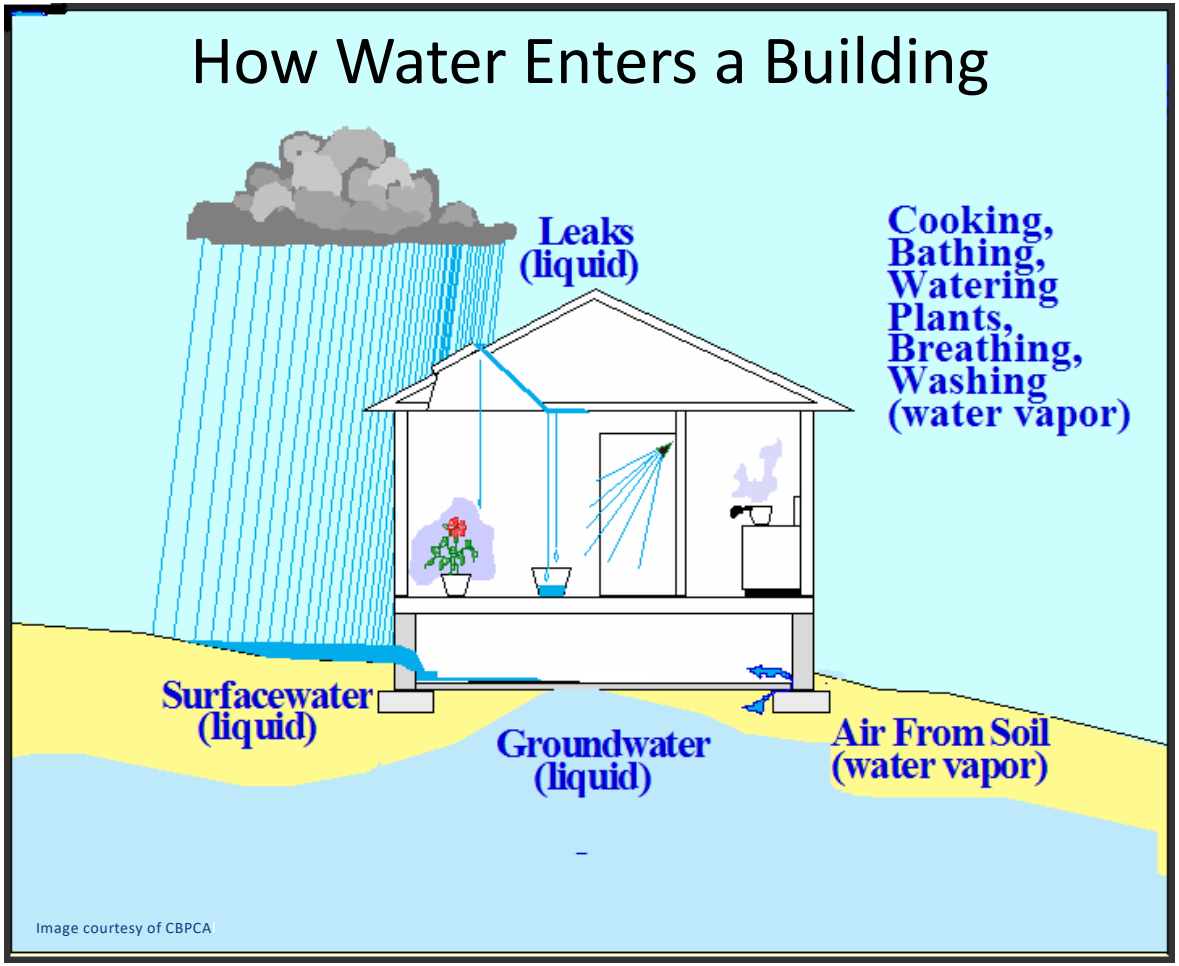
MECHANICAL EFFECT

- Possibly the largest driving force in a home
- When mechanical fans are operated within a home pressure imbalances occur
  - Kitchen & Bathroom Exhaust fans
  - Clothes dryer
  - Whole house vacuum systems
  - Air Handler
- These pressures can be large enough to double the home's air leakage rate.

Consequences of Poor Enclosure Details

- Increased energy consumption
  - Loss of conditioned air / addition of unconditioned air
- Decreased comfort
- Compromised indoor air quality
  - Particulate issues
  - Crawl space odors
- Structural / Durability issues
- Moisture issues

How Water Enters a Building



Summary

- Identify the **Source** – heat, lack of heat, moisture . . .
- Determine the **Pathway** – How is the problem entering?
- Determine the **Transport** mechanism

- Begin by exploring where, how and why this pathway or pathways are being activated
- When confronted with an issue inside a building remember that a pressure difference is often the root cause exacerbated by fans
- Figure out what driving force or combination of driving forces may be the pathway


Photo courtesy of Judy Rachel

Judy Rachel
Home Performance Pro

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ENCLOSURE ISSUES


Air seal wall to roof/ceiling T&G


Air seal perimeter exterior wall to roof/ceiling T&G, especially on exterior. Ideally both exterior and interior.


Air seal kneewalls to T&G



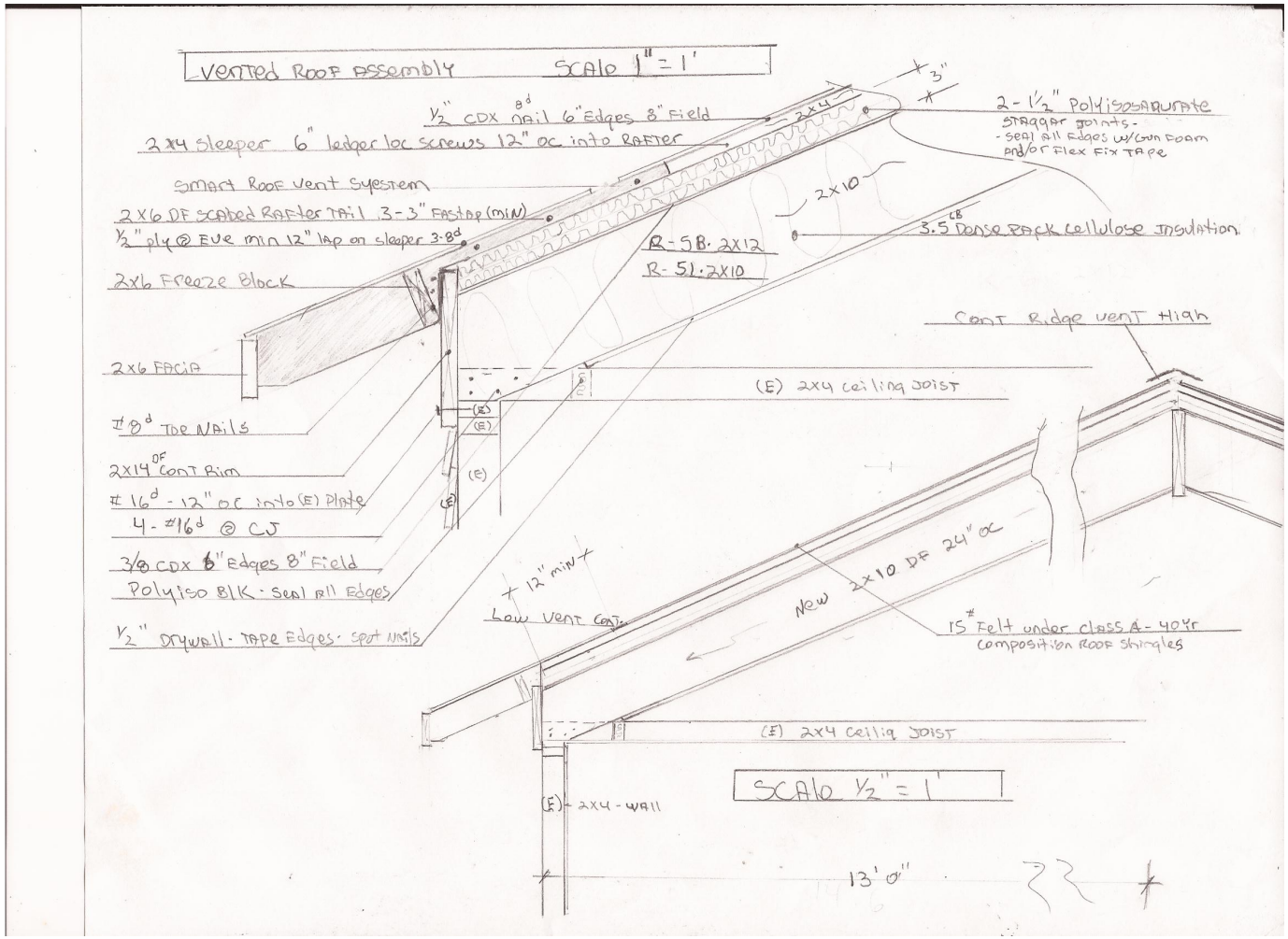
Courtesy of Terry Nordbye:
https://www.3c-ren.org/on-demand-trainings/?_odt_instructor=air-sealing-solutions-terry-nordbye

Vented Vaulted Roof Assembly example detail

Note: the vent channel is below the upper roof sheathing, above the insulation. I think I misspoke on the webinar regarding this detail.

A continuous ridge vent is needed in this assembly as well.

In a completely unvented assembly a Vapor Diffusion Port can be considered: https://basc.pnnl.gov/code-compliance/controlling-moisture-unvented-attics-code-compliance-brief



Roofing nail shows signs of moisture

Install a ground source vapor barrier on top of crawlspace soil for greatest reduction in interior water vapor

Air seal penetrations in the subfloor if keeping crawlspace as a vent.

IRC R408.2 Openings for under-floor ventilation

Exceptions: 1. The total area of ventilation openings shall be permitted to be reduced to 1 sq ft per 1500 sq ft of the under-floor where the ground surface is covered with an approved Class I vapor retarder material. 2. Where the ground surface is covered with an approved Class I vapor retarder material, ventilation openings are not required to be within 3 feet of each external corner of the under-floor space provided that the openings are placed to provide cross ventilation of the space.

Make sure the walls have all 4 control layers intact and in good condition before insulating uninsulated walls.

Drill and fill from the interior so as not to compromise the wall's weather resistive barrier layers.

HOMES WITH UNINSULATED WALLS

To insulate or not to insulate?

Water-Managed
Wall Systems
by Joseph Lstiburek
March JLC 2003

https://www.jlconline.com/how-to/exteriors/water-managed-wall-systems_o

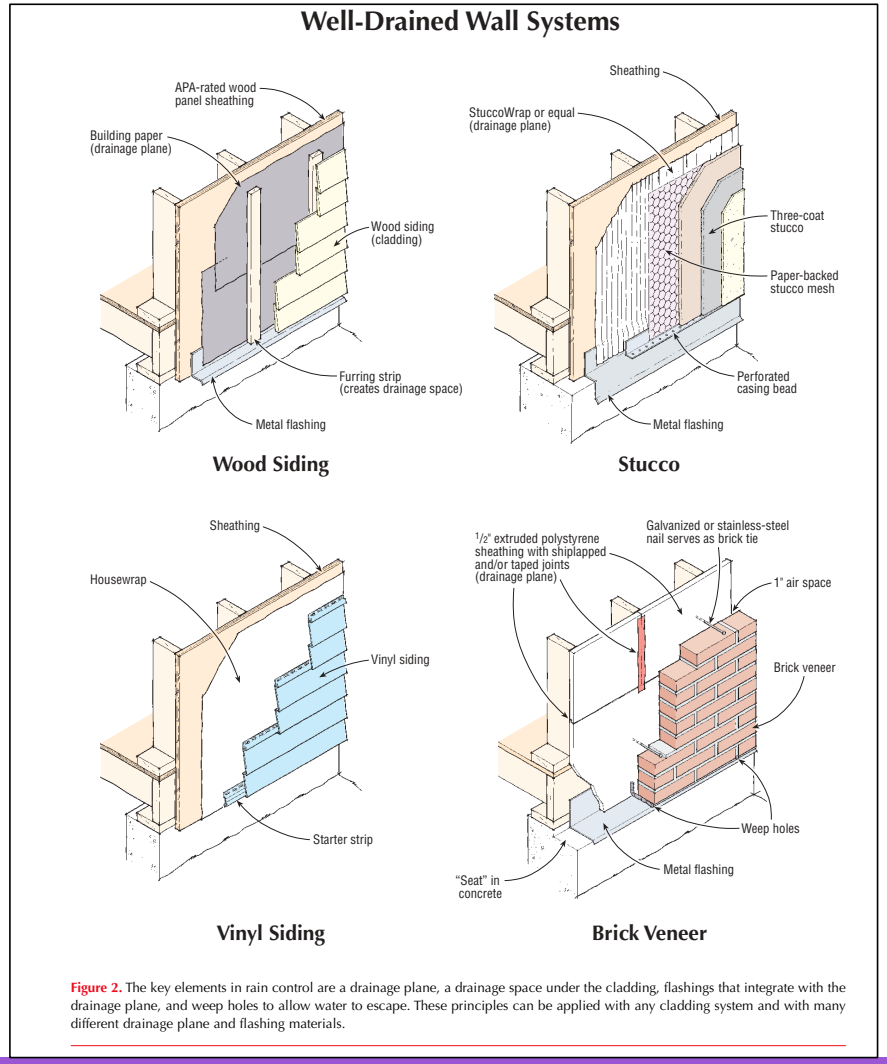


Figure 2. The key elements in rain control are a drainage plane, a drainage space under the cladding, flashings that integrate with the drainage plane, and weep holes to allow water to escape. These principles can be applied with any cladding system and with many different drainage plane and flashing materials.

RR-0999: Drainage Planes and Air Spaces

https://buildingscience.com/documents/reports/rr-9909-drainage-planes-and-air-spaces/view

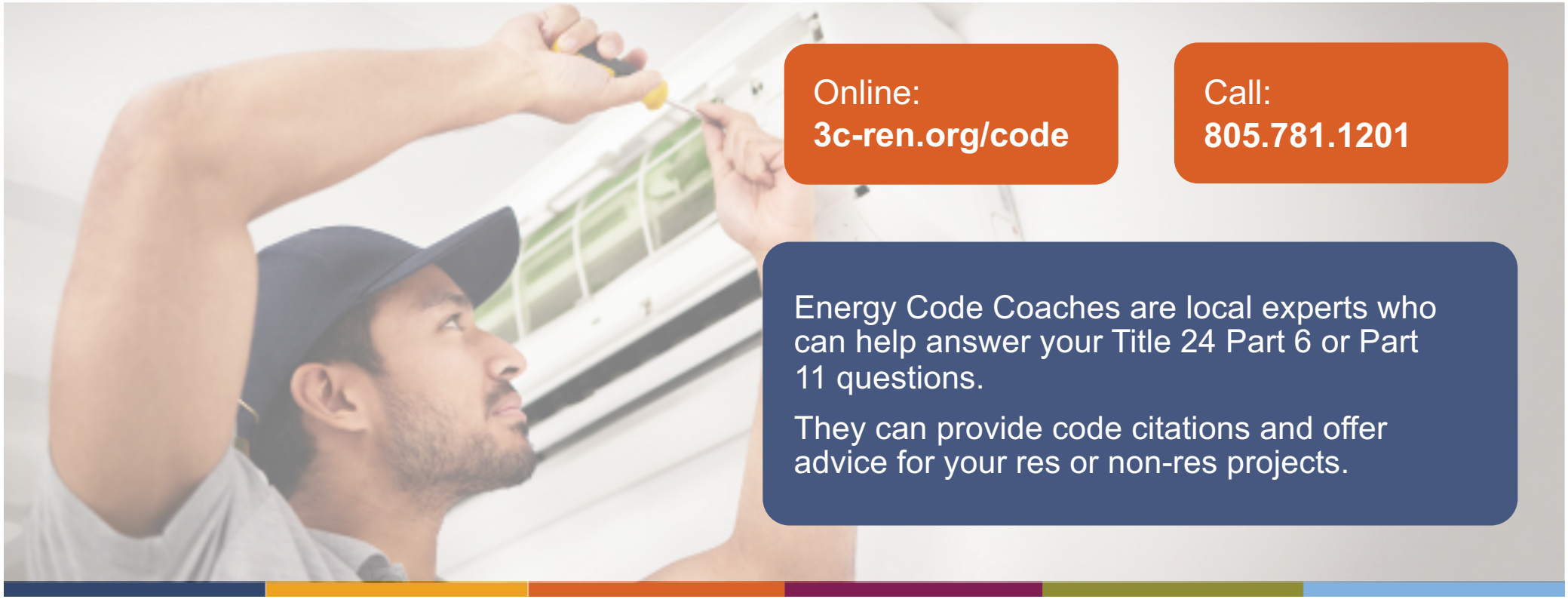
Plants Need To Be Watered
Not Houses

When walls are insulated with vapor impermeable materials on the exterior we must make sure that the walls can release water vapor to the interior.

In uninsulated walls cold walls can succumb to mold growth. This happens when furniture, mirrors, wallpaper limits interior conditioned air from warming the exterior walls.

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.

Thanks for Joining!

Continuing Education Units Available

- Contact chloe.swick@venturacounty.gov for AIA LUs

Coming to Your Inbox Soon!

- Slides & Recording

Upcoming Courses:

- Building The Future: High Performance Construction in California (9/9)
- Next Generation Passive Solar (9/23)
- **Passive Design/Build Boot Camp in VENTURA (9/29)**

Thank you!

More info: **3c-ren.org**

Questions: **info@3c-ren.org**

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