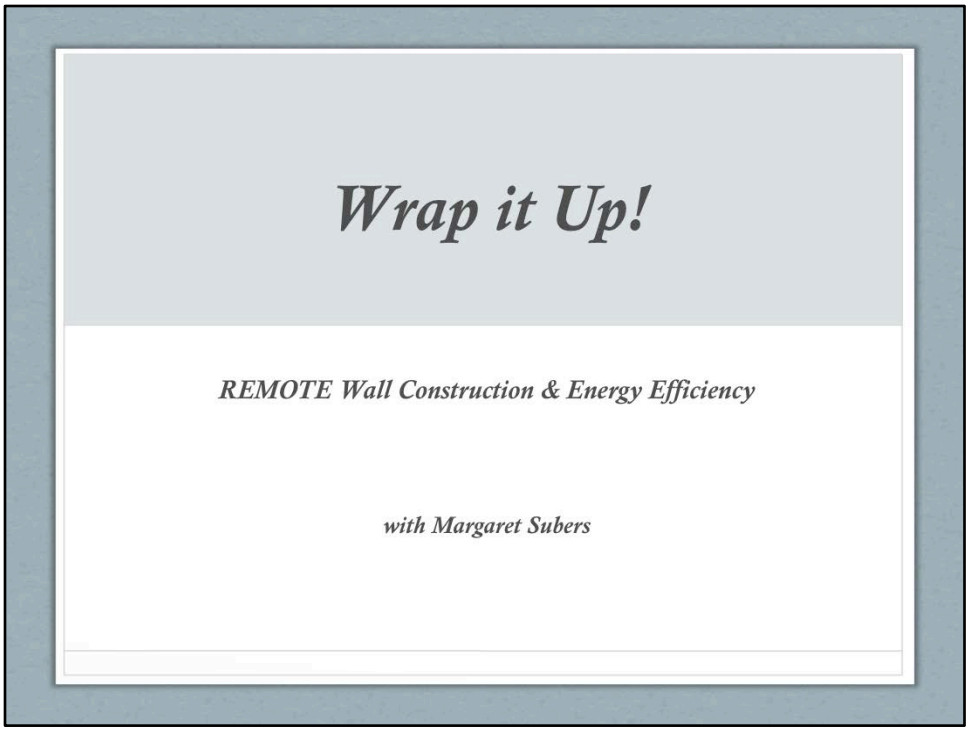
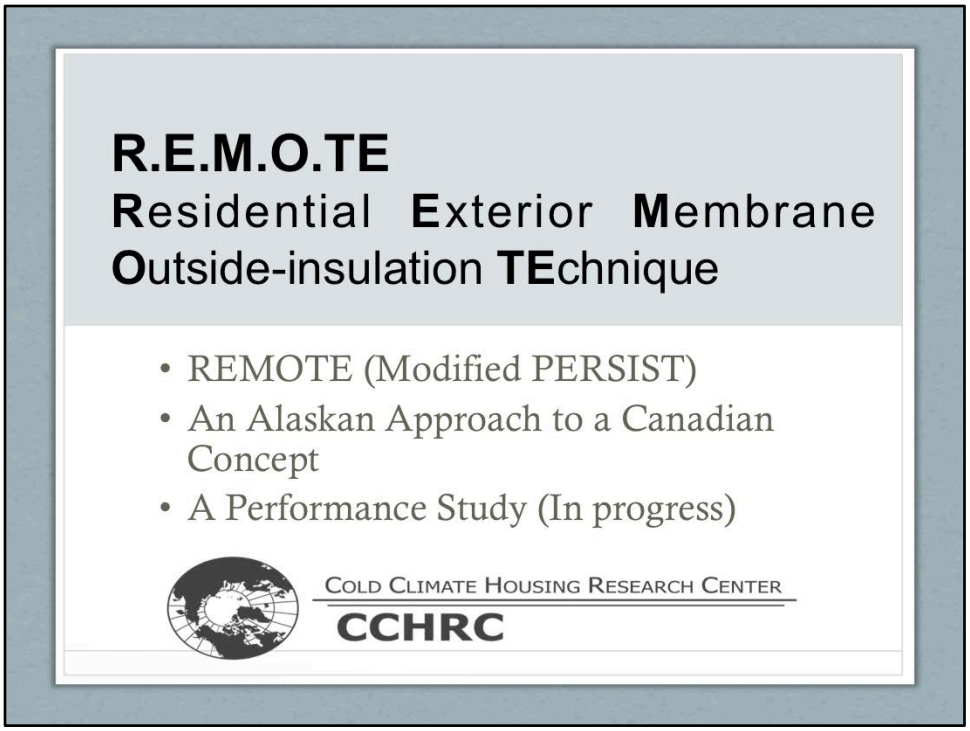
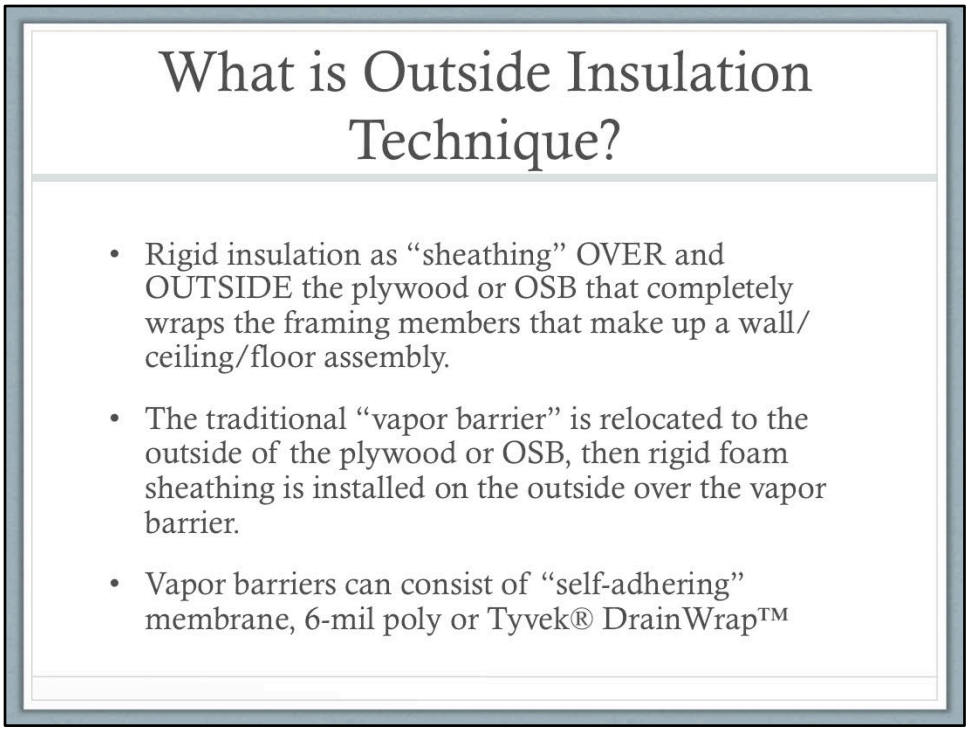

Wrap it Up!
REMOTE Wall Construction & Energy Efficiency
with Margaret Subers



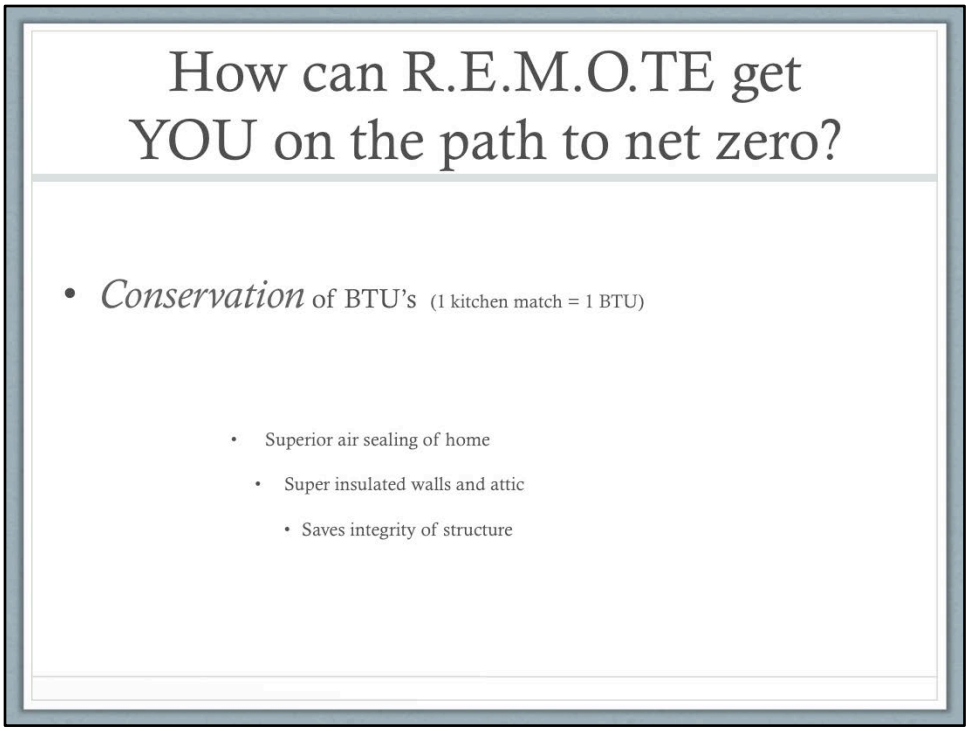

Persist-Pressure-Equalized Rain-Screen Insulated Structure Technique
What is REMOTE?
How can this building style get YOU on the path to net zero?

# What to take with you from this presentation?

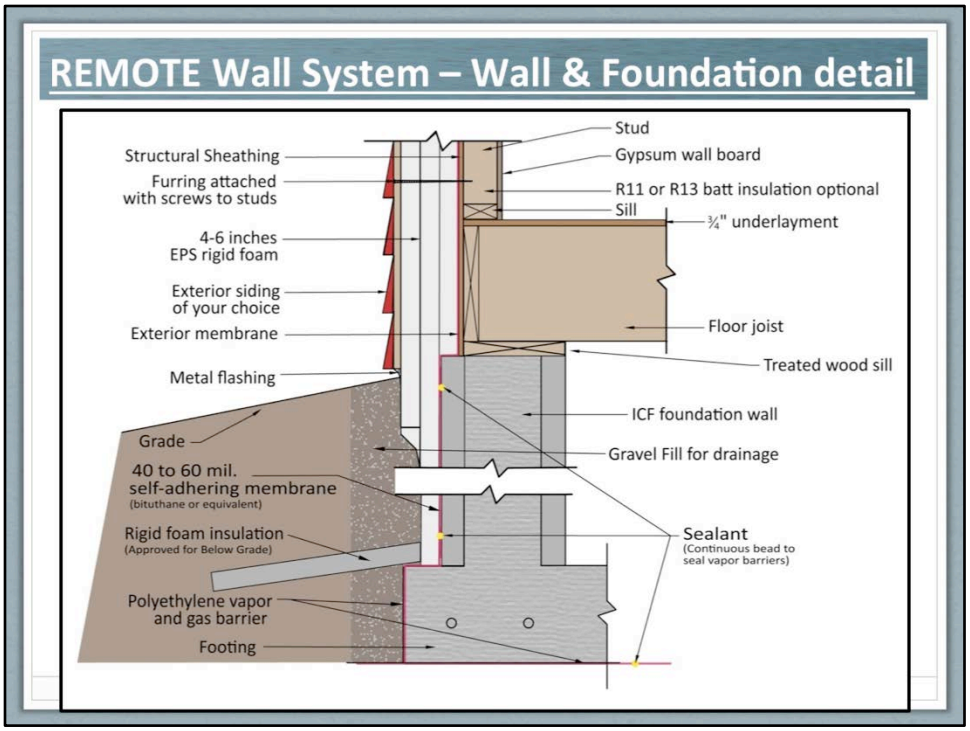
- Understanding of the basic dynamics in building science that influences the homes we live in.
- Identify the components necessary for a safe, durable and healthy home.
- Improve/advance your steps toward NET ZERO ENERGY and a more comfortable home with reduced energy costs!



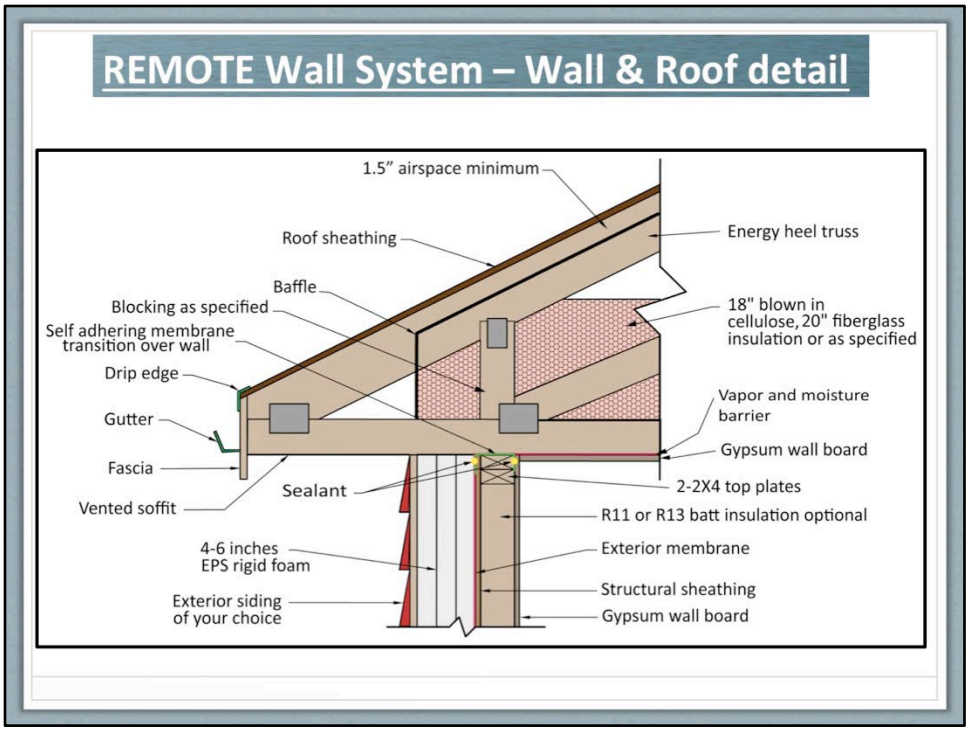

As opposed to a standard construction method using a interior vapor barrier, stick framing and siding on outside of plywood or sheathing.




Traditional stick frame construction can be more time consuming and in addition to that, the dew point in a 2 x 6 wall in very cold temperature with a standard interior vapor barrier will typically be within your wall cavity!




Details of this are in your manual and on the CCHRC.org website



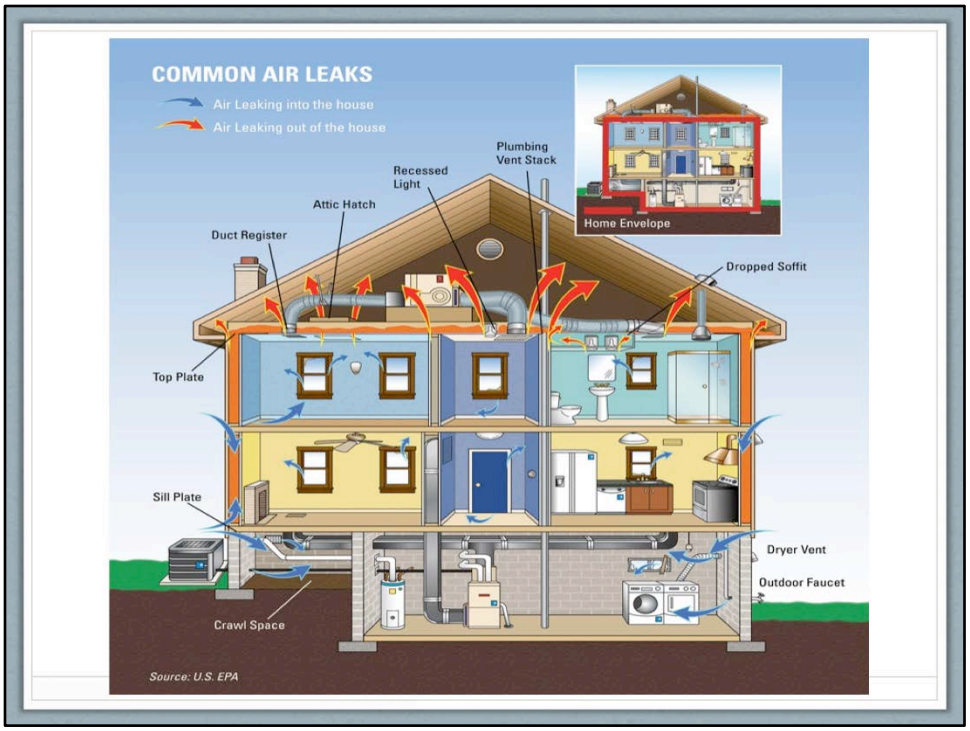

Insulation at attic must "envelope" the building and connect with the wall insulation. Interior vapor barrier connections are especially important at the eave.

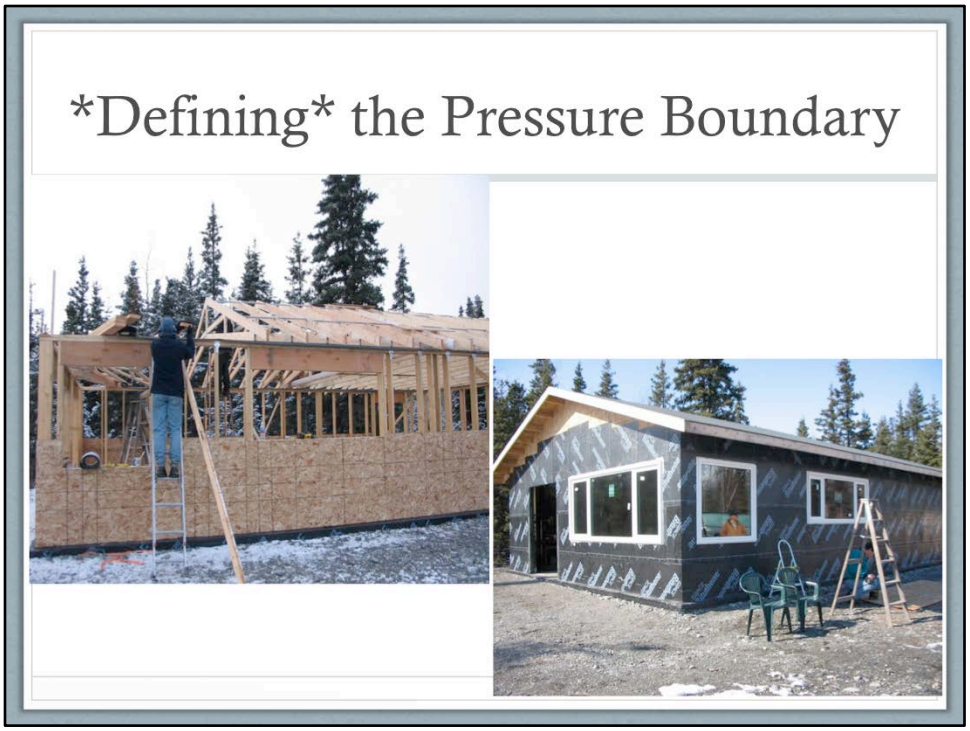

If building with new construction it is important to work the REMOTE details into your foundation. It is relatively simple. You just have to prepare for it ahead of time.

# Pressure and Thermal Boundary

- **The Pressure Boundary**
  **is the air block between Conditioned indoor air and Unconditioned outdoor air.**

- **The Thermal Boundary**
  **is the insulation between Conditioned indoor air and Unconditioned outdoor air.**

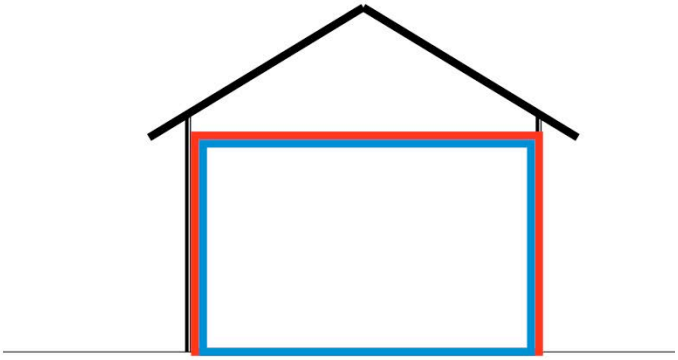

COMMON AIR LEAKS
Air Leaking into the house
Air Leaking out of the house
Plumbing Vent Stack
Recessed Light
Attic Hatch
Duct Register
Home Envelope
Dropped Soffit
Top Plate
Sill Plate
Dryer Vent
Outdoor Faucet
Crawl Space
Source: U.S. EPA




In remote, a membrane is attached around the top plate for a contiguous seal. The wall and ceiling and footer are all encased to the slab

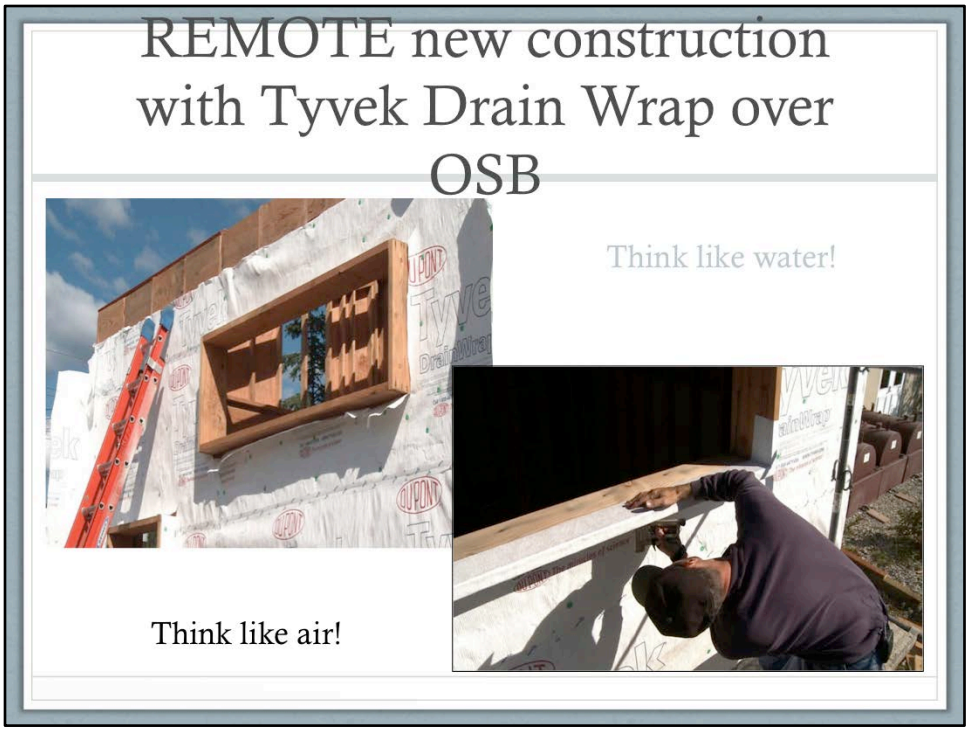
# Pressure and Thermal Boundaries

- **The Pressure Boundary and Thermal Boundary must be together and continuous.**

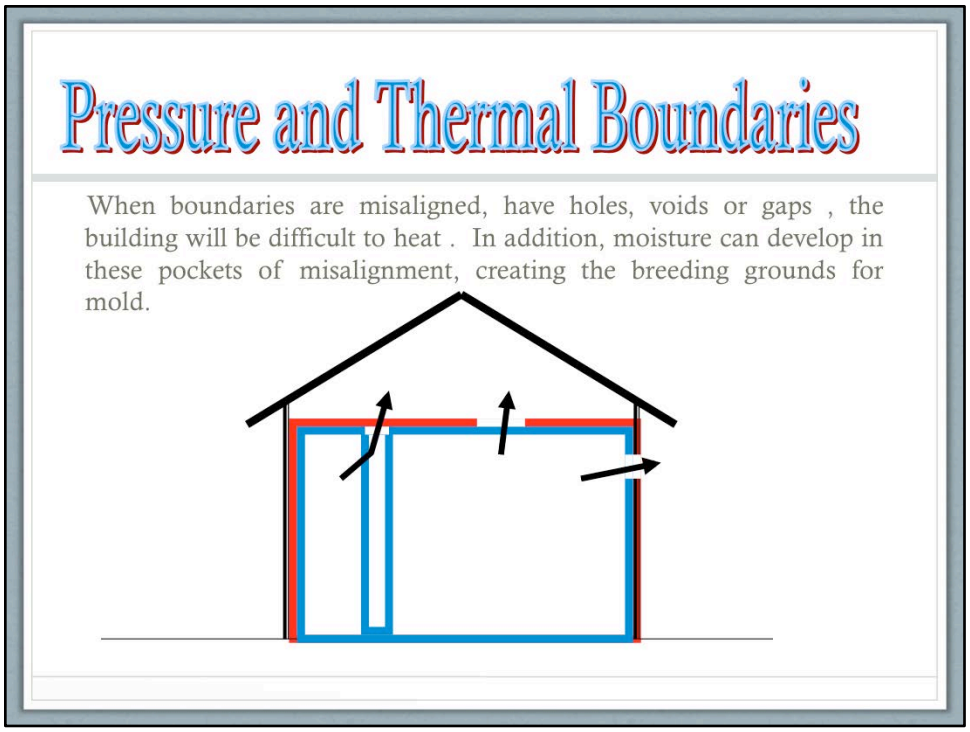



Examples of pressure boundary on different homes. All six exterior sides of a home should have a pressure boundary.


CCHRC has tried various methods to try and reduce costs for any building method. At one point they used poly with tyvek wrap together. Now the newest method is the Tyvek Drain Wrap.




Window and door details are important.  Think like water. Think like air.

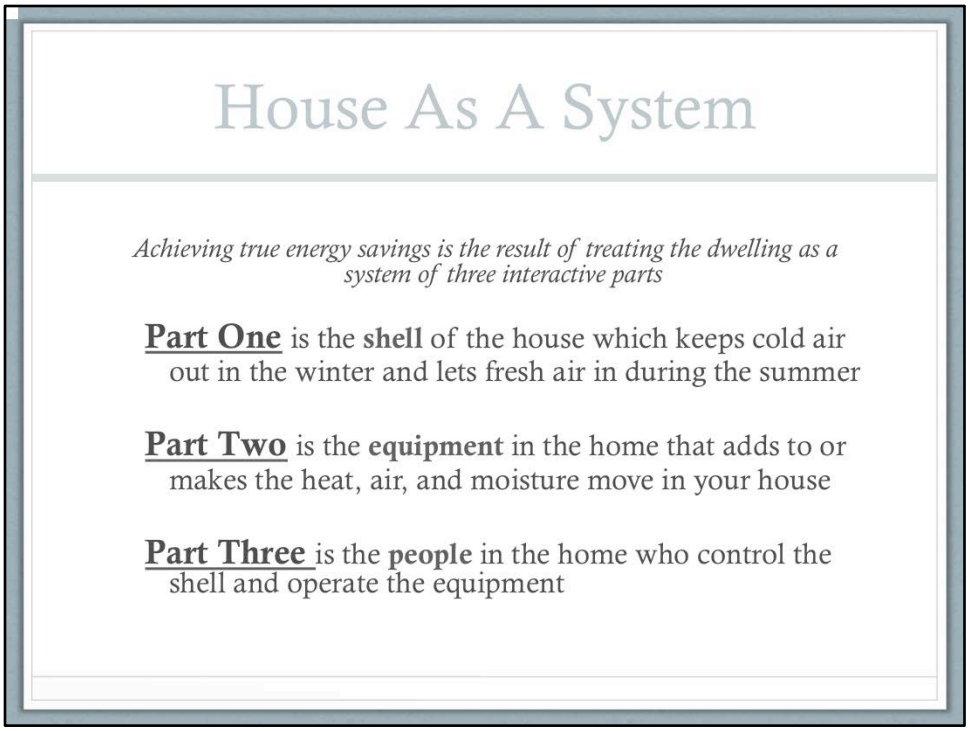



Interior partition walls, floor/wall/ceiling connections are typical places for air leakage as well as attic bypasses and wall penetrations.

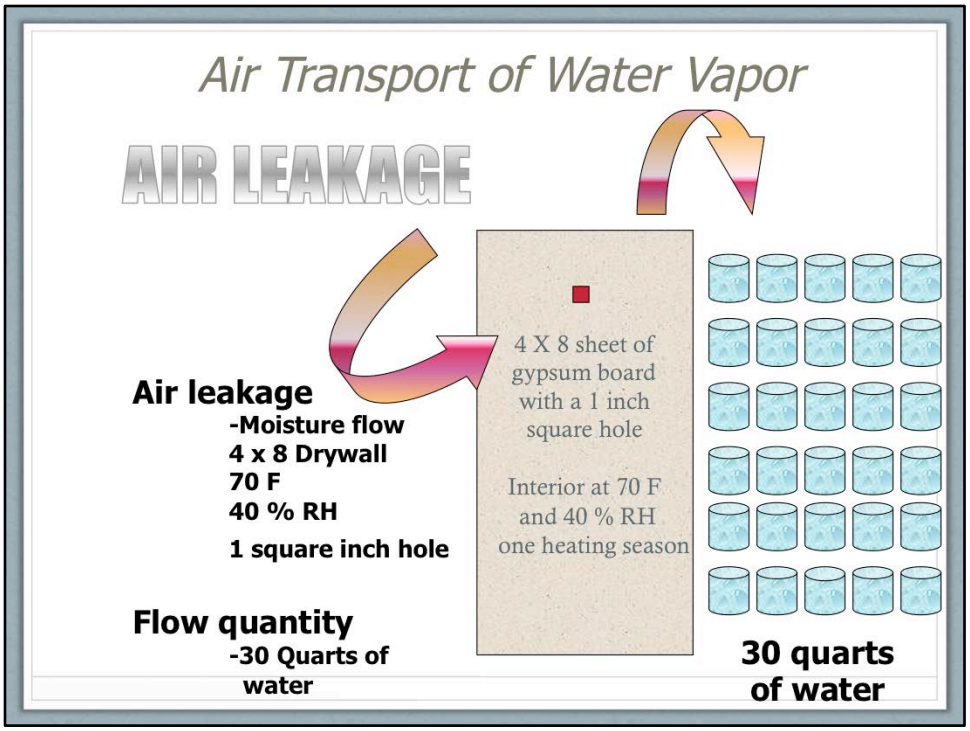

This is the kind of detail that is simpler than it "seams"! Peel and stick membrane works best for the top plate and exterior portions of foundation insulation. Really it is that we don't want the water accumulating on the inside of our wall where we typically get our Make up air!

## The Moisture issue.

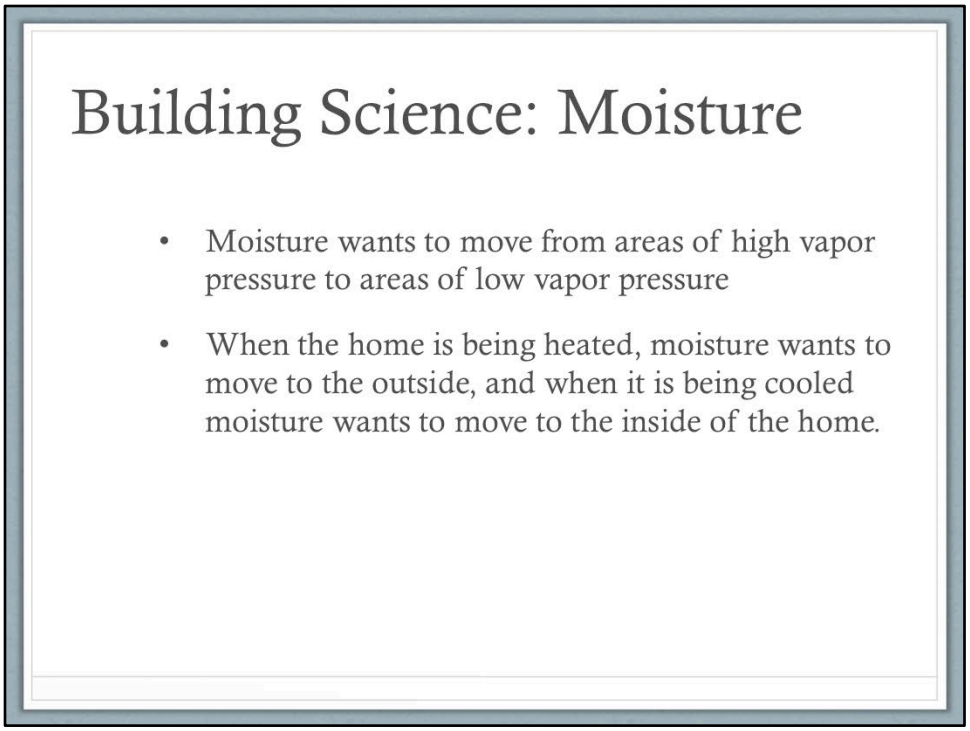
**Controlling the moisture generated in the interior living environment and preventing it from escaping into a home building shell is one of the biggest challenges of home building in cold climates. The physics governing temperature, pressure, and humidity imbalances contribute to a phenomenon referred to as "vapor drive." Moist indoor air will migrate through any deficiencies in a building wall assembly in order to reach equilibrium with the outside environment. In conditions where high indoor humidity levels coincide with significant indoor-outdoor pressure and temperature differences, traditional vapor retarder systems can fail due to imperfect sealing. Any penetrations—such as those caused by electrical outlets, fasteners or vents—create vulnerabilities if they are not detailed meticulously. As a result, any moisture that migrates through an imperfect interior vapor retarder can condense and become trapped in the wall. If these conditions persist, mold and rot can grow inside the building envelope. Mold growth can cause major structural and health problems.**



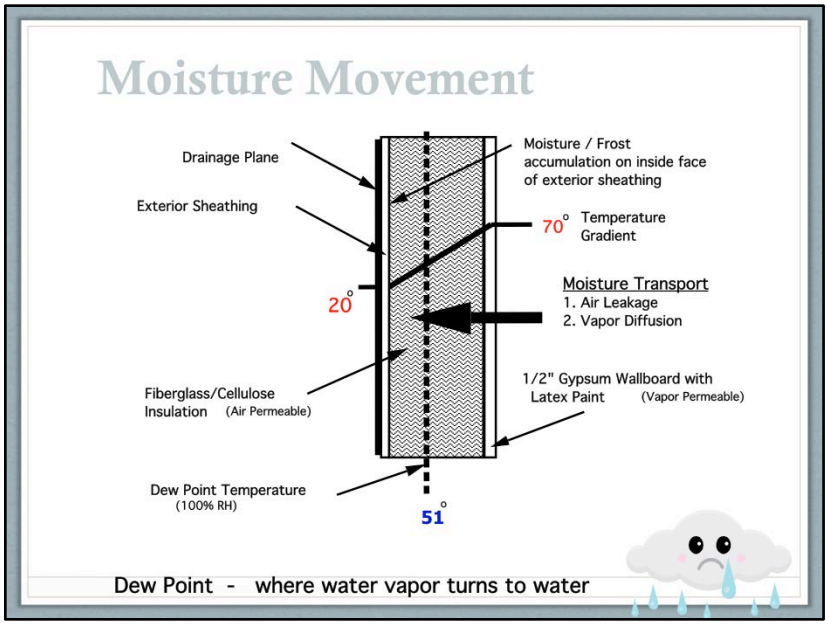

The occupants are one of the biggest factors in moisture control and IAQ.



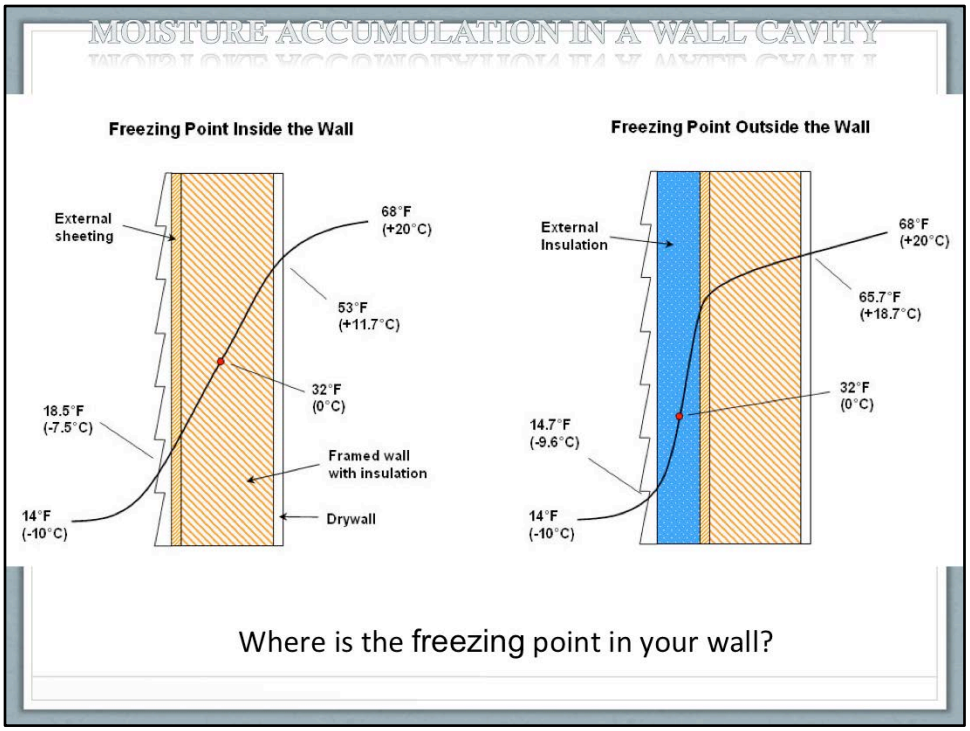

There are many sources of moisture in a home. Moisture can range from dew point condensation, water leaks from roof/windows/doors/ pipes, underground water drainage issues and finally the occupants and activity of the home. With our energy efficient Alaska homes we don't have enough air movement for evaporation of this moisture.



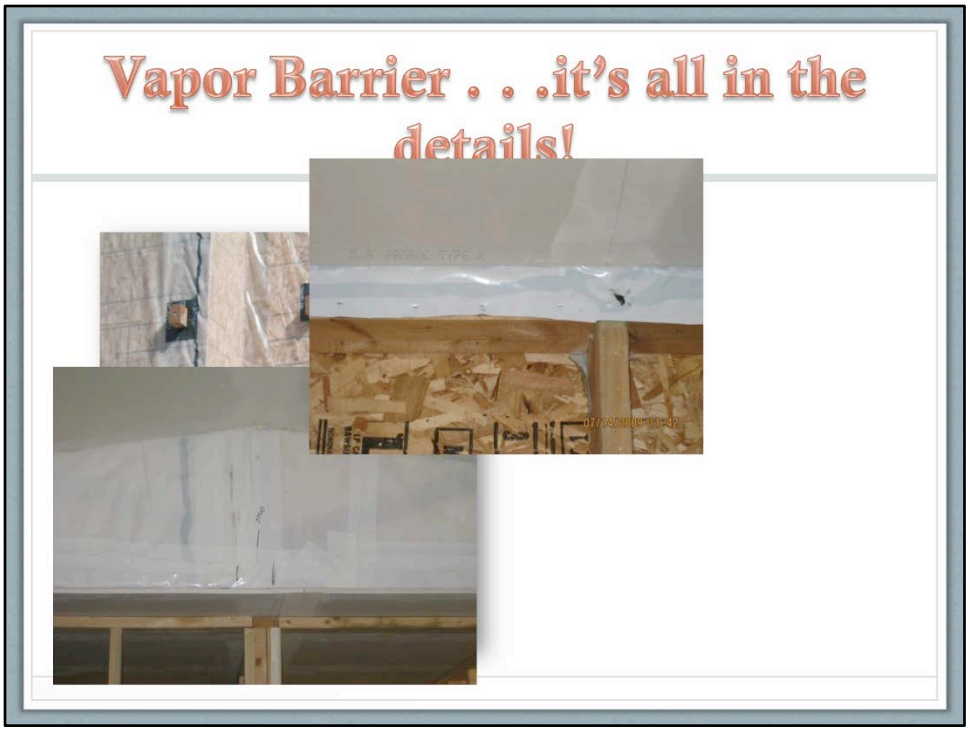

Moisture wants to move from areas of high vapor pressure to areas of low vapor pressure. Vapor pressure is the pressure exerted by water molecules in a mixture of air. An example: when the home is being heated, moisture wants to move to the outside, and when it is being air conditioned, moisture wants to move from the outside to the inside of our homes.



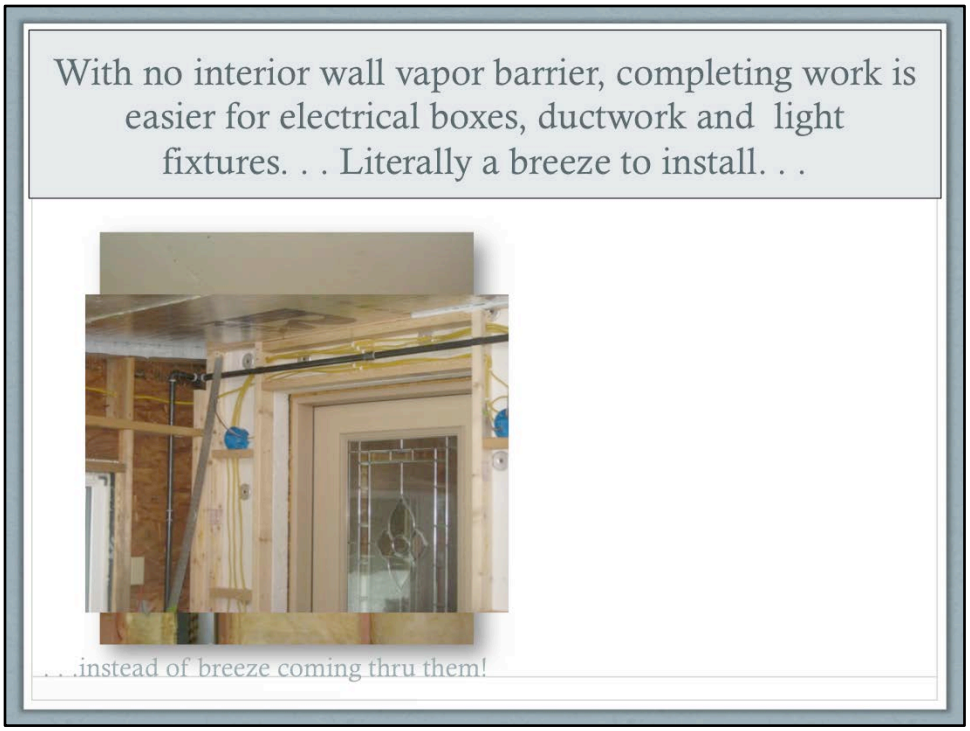

One more way to look at it. This is one the most important points of a remote or outside insulation technique. Where is the dew point in the wall. Remember that with conventional construction, in very cold temperatures, it is always in the wall cavity. Typically in most of Alaska, there are not enough days of temps higher than 70* for drying the inside of the wall cavity!




This is where the proper insulation proportions OUTSIDE your wall really shine. They push the dew point outside of your wall cavity. Moisture in a wall cavity will freeze when temperatures drop.

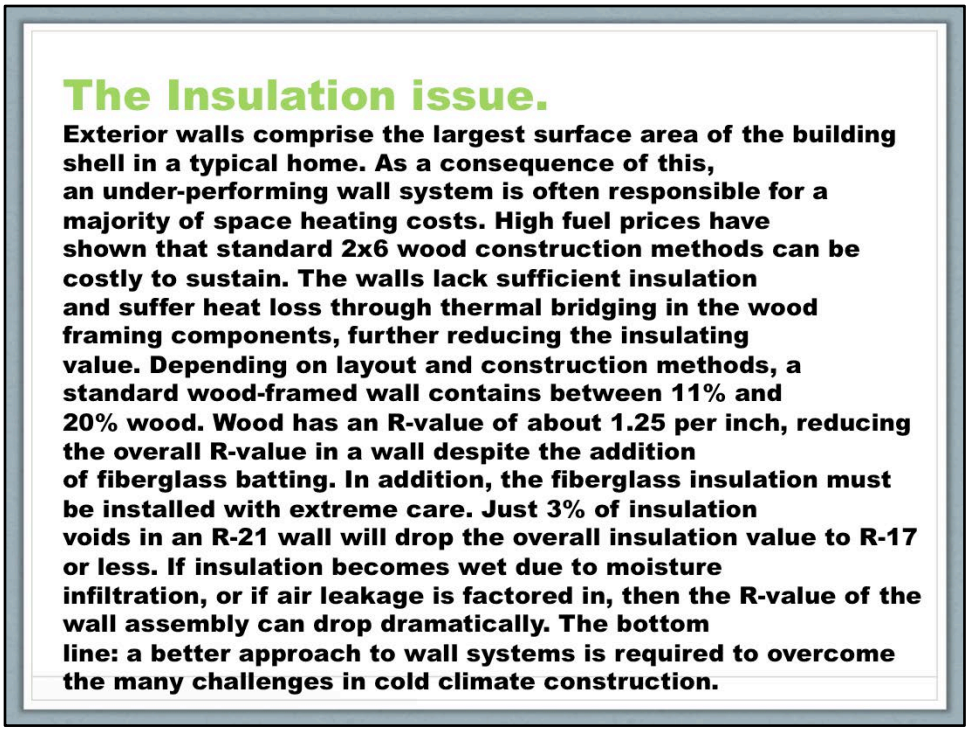



Gable transition of scissor truss to attic truss. Top plate to ceiling vapor barrier connection (wall to ceiling connection is covered!) Finally blocking for decking or overhangs are relatively simple.
Remember to find out what your local codes are for any construction project…new or remodel. Remember to attend ACAT's upcoming presentation for Green Building Codes for a small planet.




No interior vapor barrier makes electrical boxes, ductwork and light fixtures a breeze to install instead of breeze coming thru them. I am sure you have been in homes, maybe your own, where you feel wind whistling through the walls. By the way, cold air drafts through your insulation (typically fiberglass) de-rate your effective R-Value.


It is important to leave enough of a lap on the top plate “peel and stick” membrane to be able to connect your interior ceiling vapor barrier. In any construction job you must plan ahead. This type of construction is in some cases easier, but it is new to the standard way of doing things, this can make it seem slow at first.




In addition to high fuel costs there is something more to consider. REMOTE done properly provides comfort to the occupant and a quiet draft free home.


After the pressure boundary (vapor barrier/air barrier are all one) you are ready to install the foam.


2 layers of 4” EPS foam were used in this application. Overlapped on all seams, filled in with spray can foam between pieces. Layer one layer two with furring strips. Now cold climate is recommending the Drain wrap over the bituthene or just Drain wrap only. No stucco used here. There is a big air gap behind the siding.

## REMOTE House in Fairbanks

Remote style construction benefits are great as cantilever floors, dormers, gables are finally easy to insulated to the amount needed. No more drafts at your feet. Houses like these are not only energy efficient but they are very comfortable to live in.


It is fairly simple to find studs on new construction


If not using furring strips when attaching the final layer of foam board, use large plastic washers and screws at least one inch longer than the total thickness of all foam board layers. The furring strips are installed with 10" screws using the furring strip as a washer. The furring strip is treated ½" plywood attached at base of sill plate and at top by Simpson ties.


Genstone is easy to work with. Ledger detail and corner trim are cut. Ledger is pre-cut. Wide corner trim is not. Big structural screws hold the furring strips on (drilled at an angle, refer to manual) and then the rest of the furring strips hold up the siding and act as a air space for drying.


Metal Flashing Pick material that are not frost susceptible

# Windows Exterior

Cement Board for Inset window buck

Proper Flashing is important


Flashing wraps around interior of sill whether it is an inset window or exterior mounted one. Make sure you leave a foamable gap around rough opening of window.

# Build it…Raise it

- REMOTE can easily be built on deck to save time.
- Connectable Tabs of membrane must be kept to make connections on corners, sills and top plates.

To

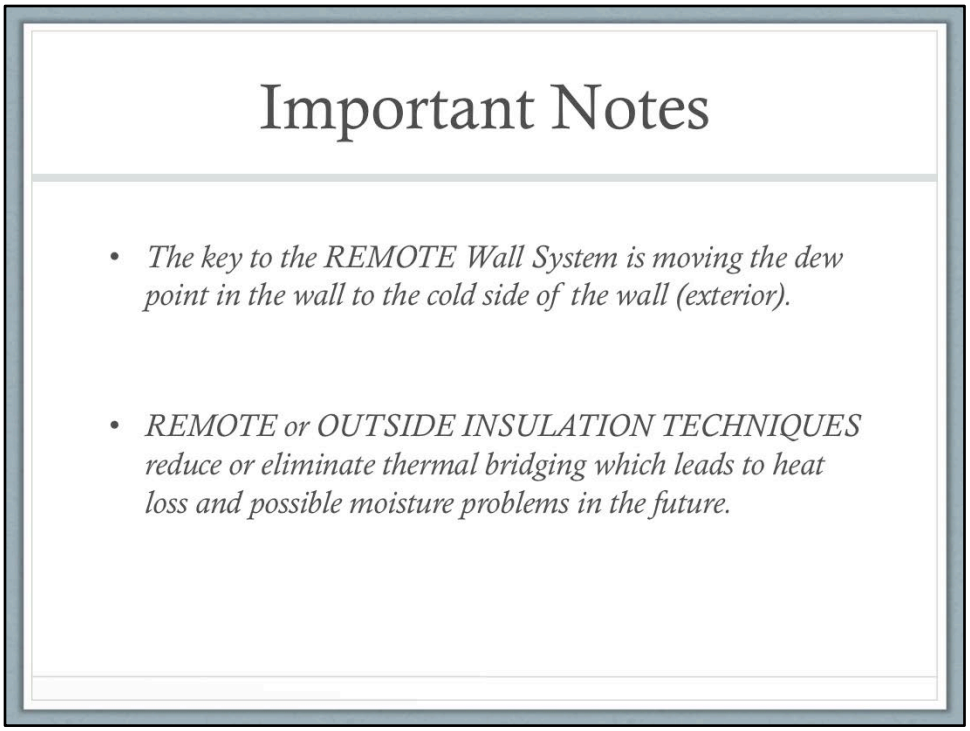
# Inset Door and Window Sills

Inset style reduces heat loss and H20 that hits window

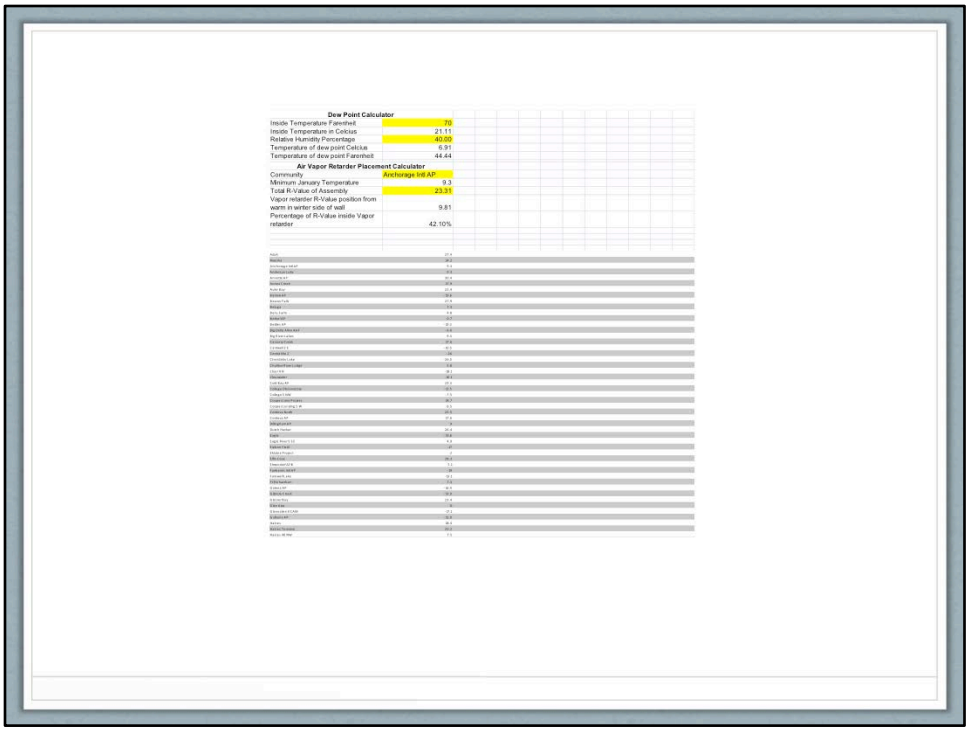
In our location we have noticed less water running down window when they are inset. (except if wind driven rain, it won't matter anyway)


In our application, the Gen Stone lent itself well to carving out flat spaces for mounting electrical boxes, water faucets and other misc. details. It is very firm and strong. After mounting, foam was sprayed into the hole and sealant was applied at opening. Inside view and outside view


Following this the screw will be covered in foam.  It seems to make quite a difference if it is sealed first.




If done properly. There could be some issues with the recent energy upgrades done with rebate program…interior vapor barriers with foam on the outside? How much? Where is the dewpoint? How much foam should you add to the outside of your studs?

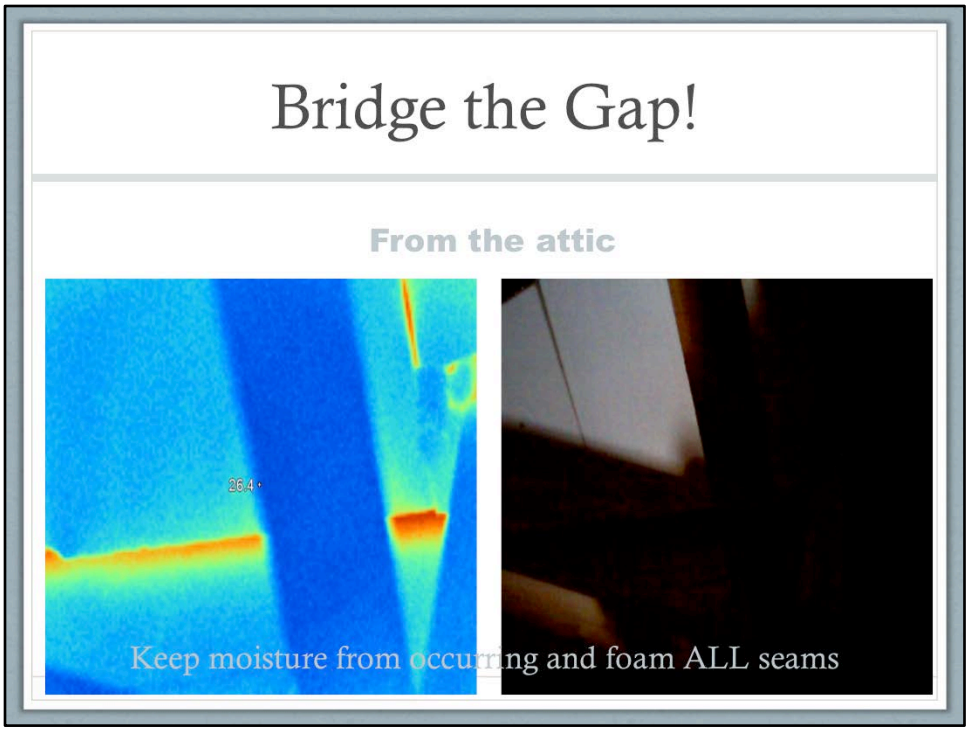


**Dew Point Calculator**

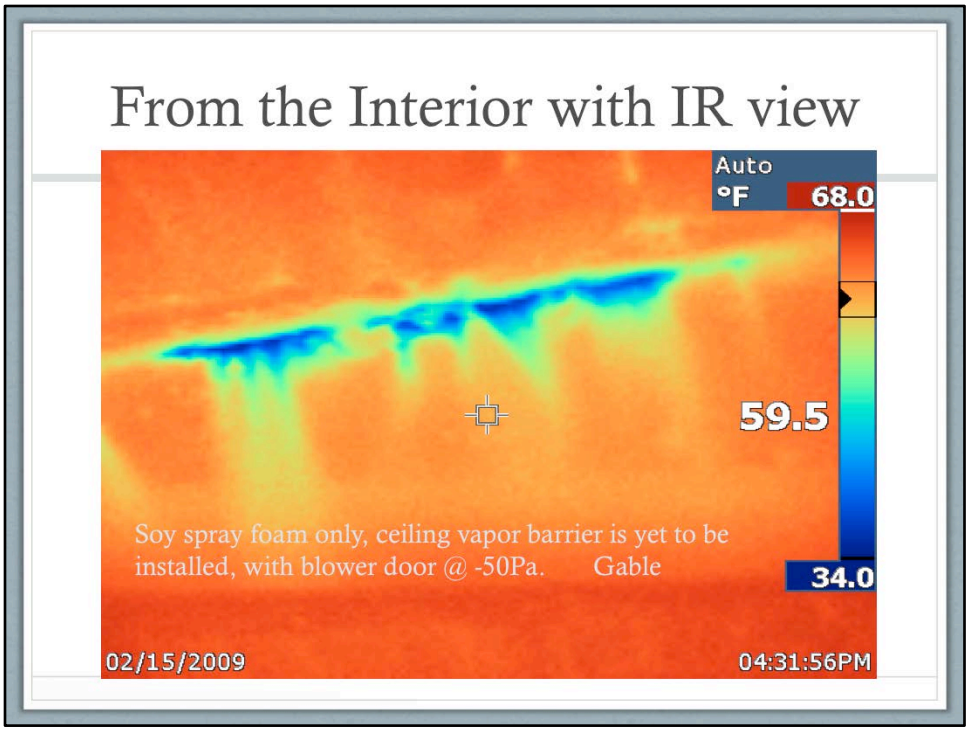
| | |
|---|---|
| Inside Temperature Farenheit | 70 |
| Inside Temperature in Celcius | 21.11 |
| Relative Humidity Percentage | 40.00 |
| Temperature of dew point Celcius | 6.91 |
| Temperature of dew point Farenheit | 44.44 |

**Air Vapor Retarder Placement Calculator**

| | |
|---|---|
| Community | Anchorage Intl AP |
| Minimum January Temperature | 9.3 |
| Total R-Value of Assembly | 23.31 |
| Vapor retarder R-Value position from warm in winter side of wall | 9.81 |
| Percentage of R-Value inside Vapor retarder | 42.10% |

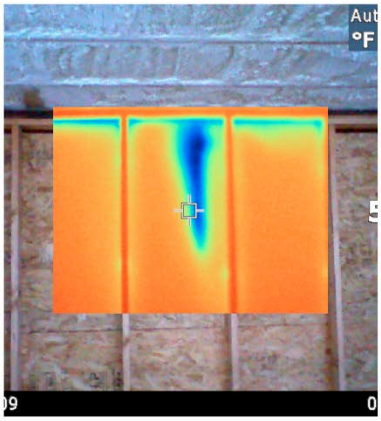



This is looking in from the attic where the scissor truss and attic truss meet creating a gable end. This is before the vapor barrier is installed and foam has not been sealed with a spray can foam gun.




On Gable end interior to scissor prior to ceiling vapor barrier installation. Soy spray foam only.

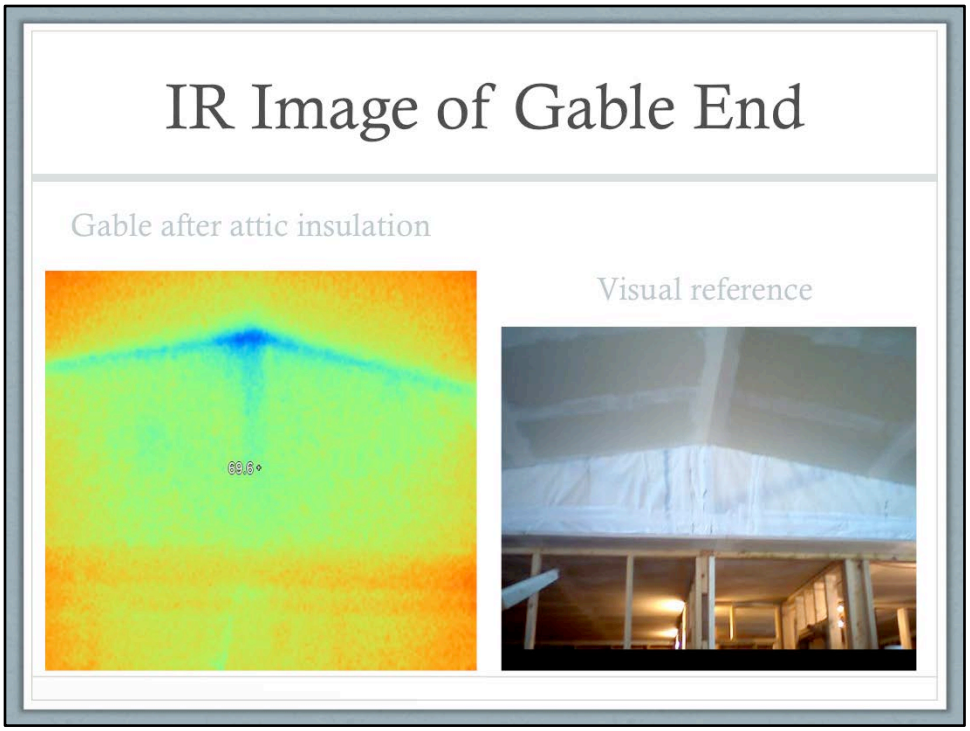
# Gaps and Goofs




- One layer of 4" foam on unfinished north wall @ -10F.
- Gap is not yet foamed.
- Temperature difference is 30+degrees!
- FOAM THE GAP☺

This is in part why in the past panel systems have failed. Standard construction can have the same consequence it is just faster when in house is tighter.

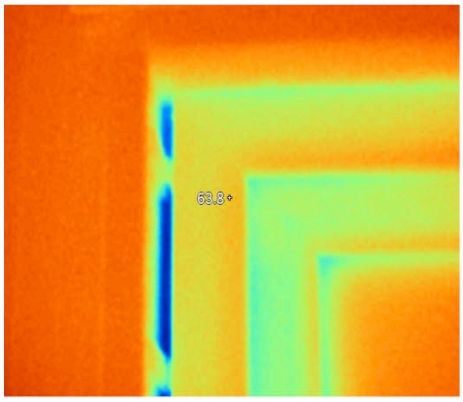

IR picture to follow.  Gap was sealed with foam before adding attic insulation.




After adding celllose to attic.  R-76 plus 4” foam (soy ) and

# IR Image of Door Rough Opening

Foam not installed around door



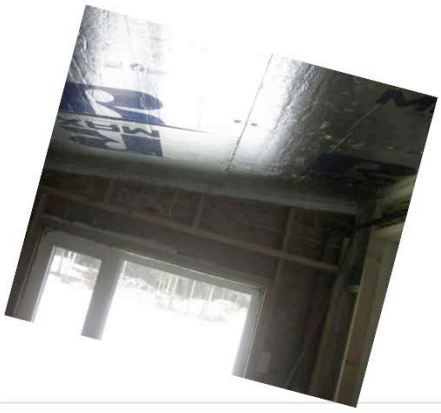

Visible reference


Due to a goof, R-max had to be added into the top plate, baffles were made from it so that desired r-value could be reached. Actually worked very well as the top plate can be a weak link in transitions to the outside. Manual shows instruction for matching truss sizes.


Foam can be sprayed at very low temps. It was -31 at the time, house was being heated with no attic insulation. As soon as foam was sprayed home was 70* F.

# Cathedral Un-vented Ceiling

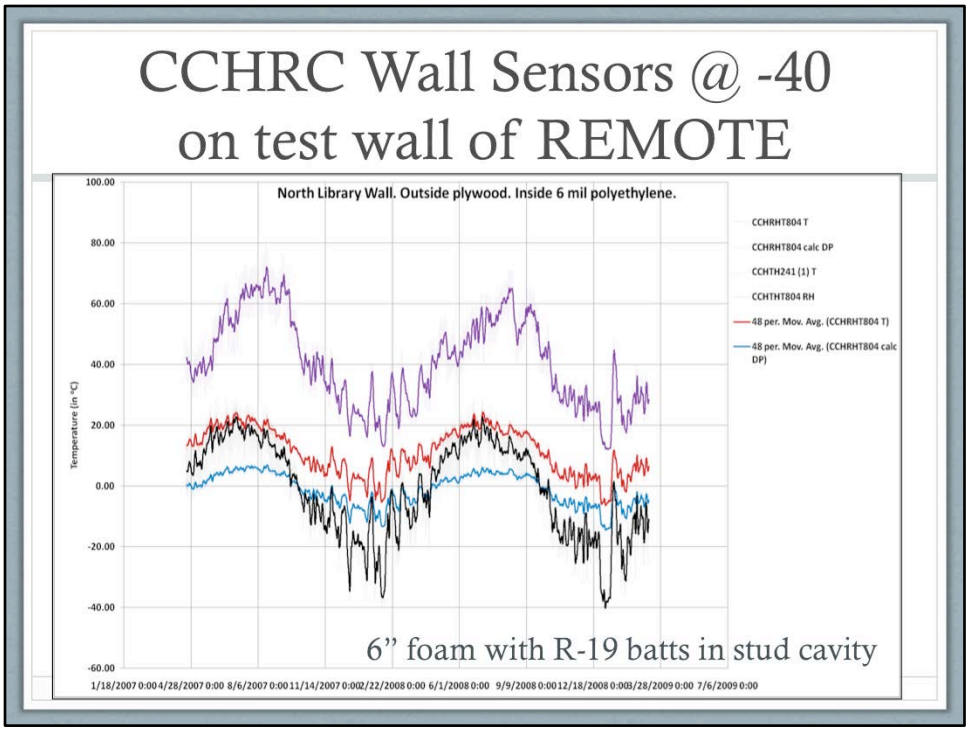
R-Max is added as interior rigid sheathing insulation to stop thermal bridging

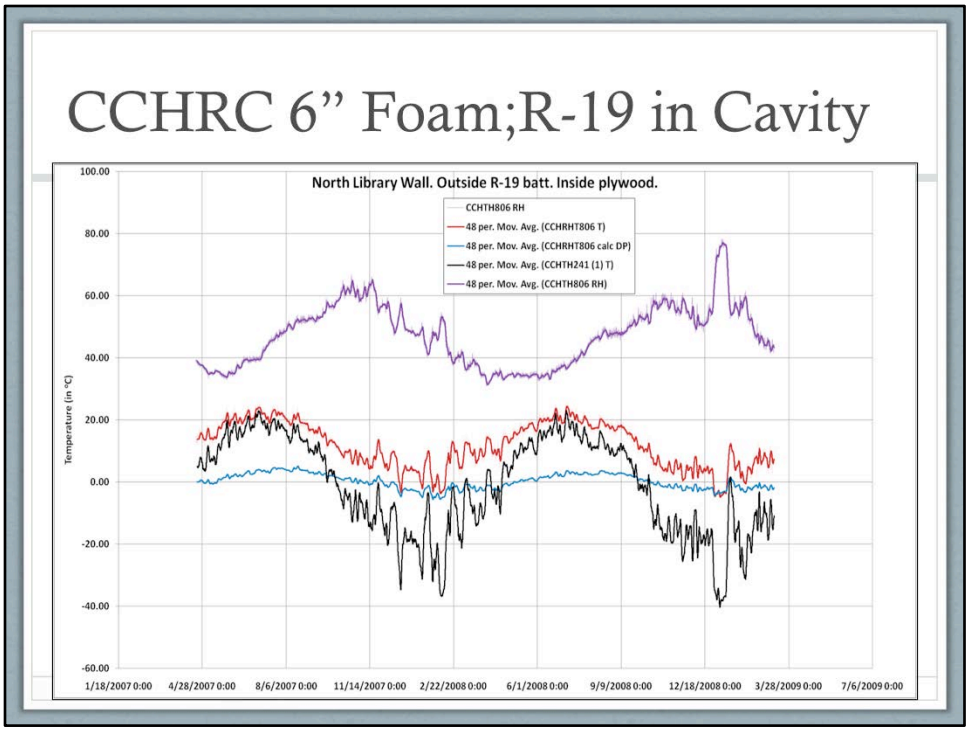
# Attic Insulation

Cellulose in attic over 4" soy foam


Venting is minimal due to wind and hoar frost. At 30-50 CFM (for 1200 sq. ft.) of leakage it should not be a problem. R-76 + SOY (15.2)=91.2




Exterior of plywood but behind poly. All graphs are tracking – come close but never hit dew point.
Black – Temperature outside of wall behind stucco
Blue calculated dew point
Red – Temperature at sensor
Purple – Relative humidity at sensor

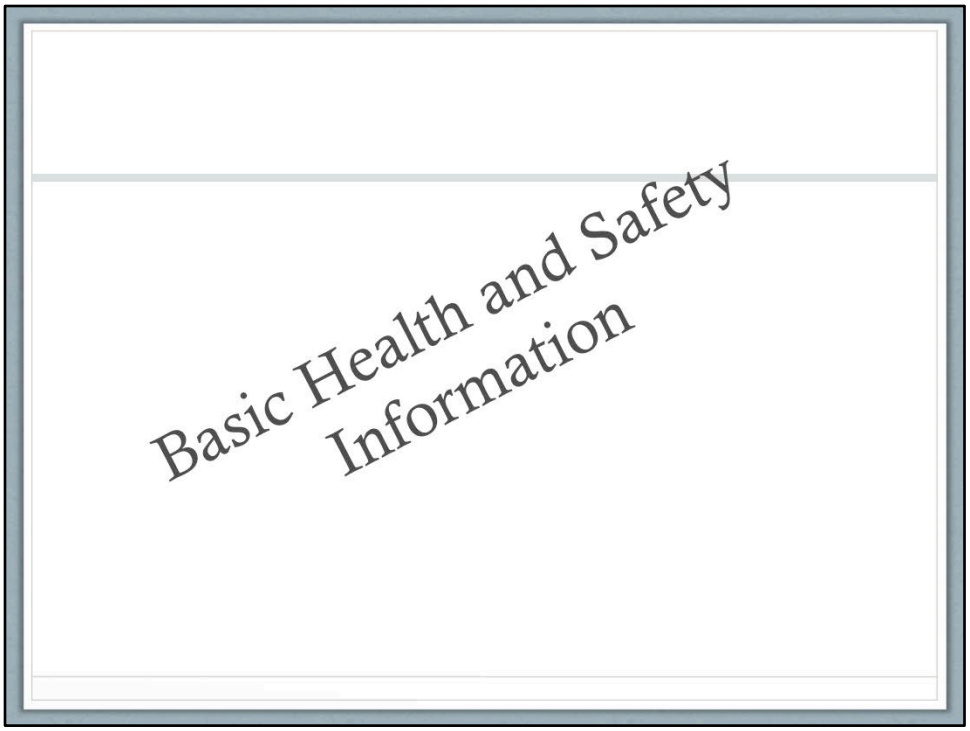


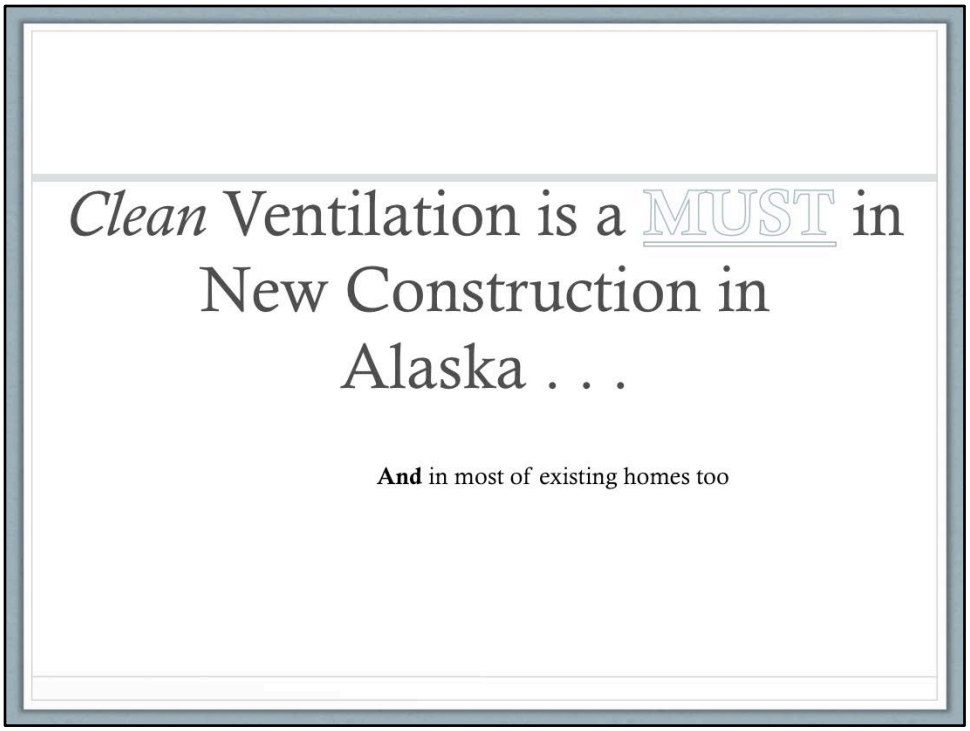

Inside plywood. Note humidity spike directly after cold snap & dew point was reached inside wall

Keep in mind this is humidity at sensor, relative to temp at sensor – air can hold less humidity than interior

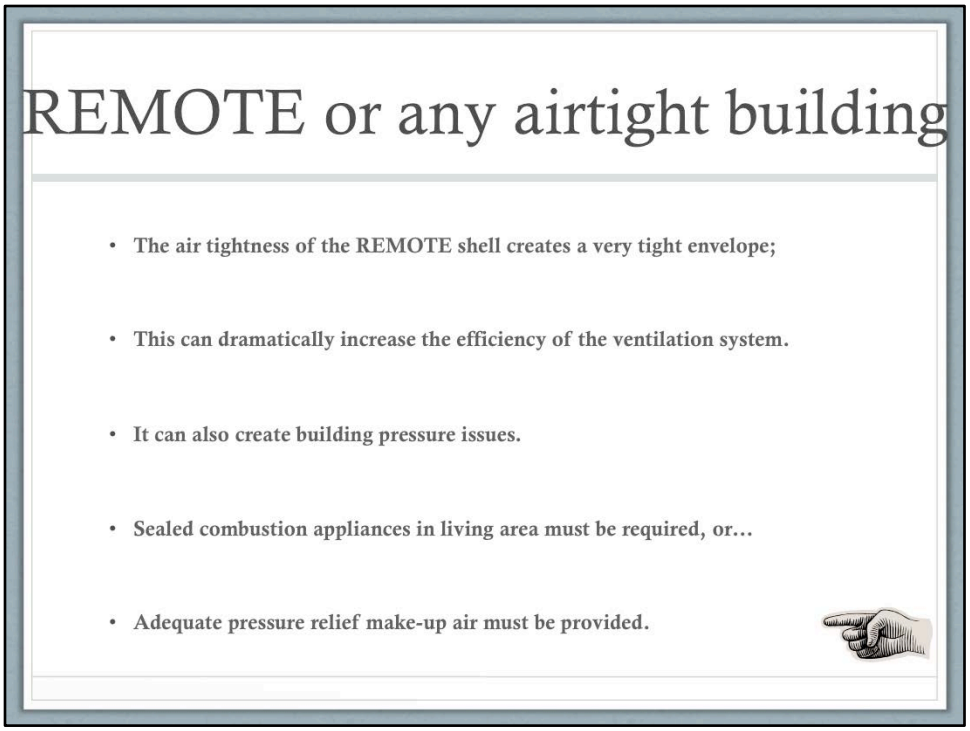
Air flow reduced Winter very dry in combination with HRV system helps balance

Framing is hygroscopic and can absorb some moisture before saturation


Basic Health and Safety
Information




Do you really want to breathe the air from your crawlspace, attic or interior partition wall? Ventilation is an integral part of the house as a system in Alaska. If you are building an energy efficient home, ventilation is critical to your health and well being as well as the longevity of your building.




Combustion safety is important with any house system. In Alaska our homes are more airtight than almost anywhere else. On a monthly basis home(s) are found with back drafting appliances during a worst case depressurization test. More Alaskans should look toward properly ventilating their homes after a thorough energy audit.

# Health and Safety

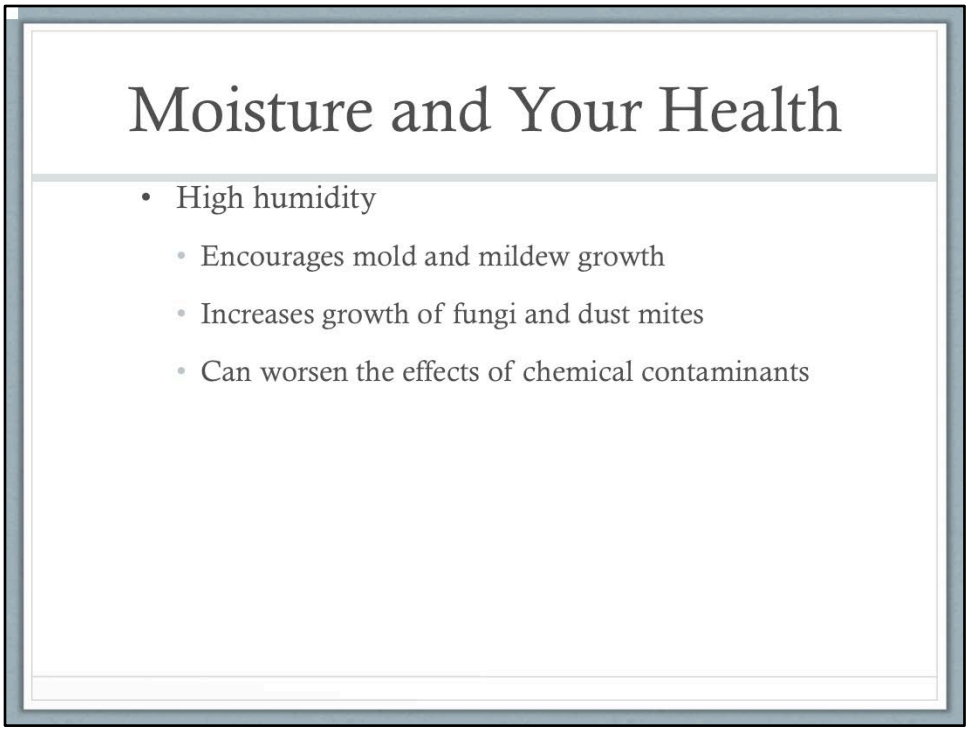
## Heating System Safety

- Draft
- Carbon Monoxide
- Fuel Leaks
- Clearance to Combustibles


## Moisture-Related Health Hazards

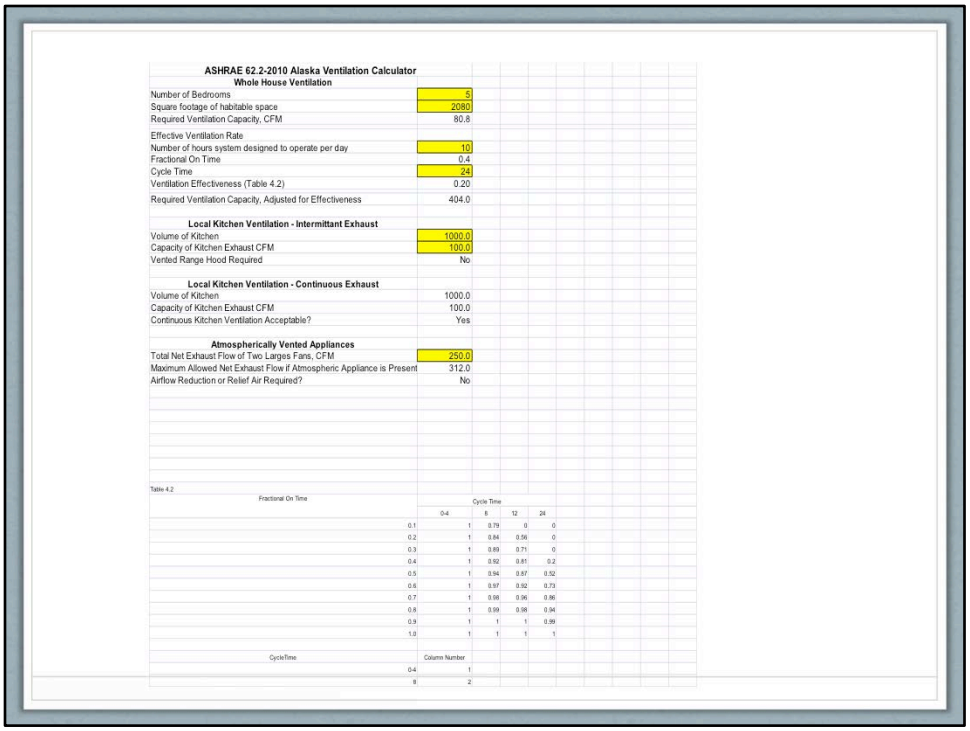
- Mold
- Mildew
- Fungi

## Ventilation/Fresh Air Exchange Issues




Ventilation is needed in a majority of homes in alaska.  Radon is found in 1 out of every 5 homes in Alaska.


How do we feel when we spend time in our house ?
How do we use the tools in our home?
Sometimes we know the least about the place we call our haven!



**ASHRAE 62.2-2010 Alaska Ventilation Calculator**

**Whole House Ventilation**

| | |
|---|---|
| Number of Bedrooms | 5 |
| Square footage of habitable space | 2080 |
| Required Ventilation Capacity, CFM | 80.8 |
| Effective Ventilation Rate | |
| Number of hours system designed to operate per day | 10 |
| Fractional On Time | 0.4 |
| Cycle Time | 24 |
| Ventilation Effectiveness (Table 4.2) | 0.20 |
| Required Ventilation Capacity, Adjusted for Effectiveness | 404.0 |

**Local Kitchen Ventilation - Intermittant Exhaust**

| | |
|---|---|
| Volume of Kitchen | 1000.0 |
| Capacity of Kitchen Exhaust CFM | 100.0 |
| Vented Range Hood Required | No |

**Local Kitchen Ventilation - Continuous Exhaust**

| | |
|---|---|
| Volume of Kitchen | 1000.0 |
| Capacity of Kitchen Exhaust CFM | 100.0 |
| Continuous Kitchen Ventilation Acceptable? | Yes |

**Atmospherically Vented Appliances**

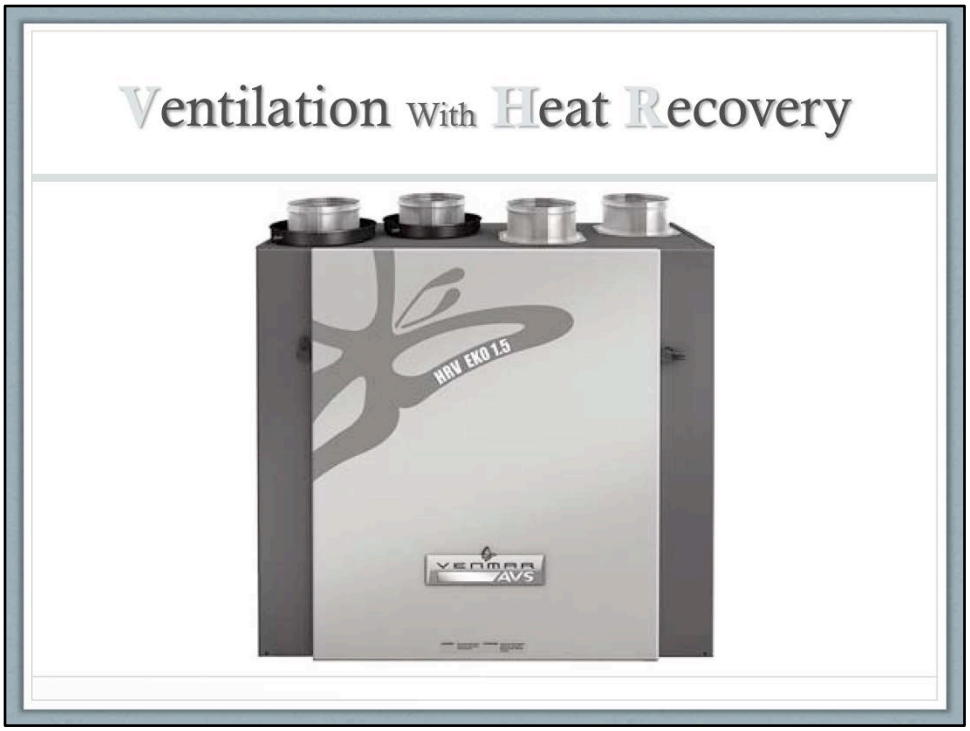
| | |
|---|---|
| Total Net Exhaust Flow of Two Larges Fans, CFM | 250.0 |
| Maximum Allowed Net Exhaust Flow if Atmospheric Appliance is Present | 312.0 |
| Airflow Reduction or Relief Air Required? | No |

Table 4.2

| Fractional On Time | Cycle Time | | | |
|---|---|---|---|---|
| | 0-4 | 8 | 12 | 24 |
| 0.1 | 1 | 0.79 | 0 | 0 |
| 0.2 | 1 | 0.84 | 0.56 | 0 |
| 0.3 | 1 | 0.89 | 0.71 | 0 |
| 0.4 | 1 | 0.92 | 0.81 | 0.2 |
| 0.5 | 1 | 0.94 | 0.87 | 0.52 |
| 0.6 | 1 | 0.97 | 0.92 | 0.73 |
| 0.7 | 1 | 0.98 | 0.96 | 0.86 |
| 0.8 | 1 | 0.99 | 0.98 | 0.94 |
| 0.9 | 1 | 1 | 1 | 0.99 |
| 1.0 | 1 | 1 | 1 | 1 |

| CycleTime | Column Number |
|---|---|
| 0-4 | 1 |
| 8 | 2 |

# Ventilation Without Heat Recovery

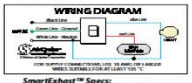



HRV –heat recovery ventilation

# Introducing the SmartExhaust™

**BATH FAN/ LIGHT SWITCH /DELAY TIMER/VENTILATION CONTROLLER**

*Set the Ventilation & delay times from 0- 60 minutes.*




***SmartExhaust™ Specs:***

| | |
|---|---|
| *Light:* | *450 Watts @ 120 VAC (blue wire)* |
| *Fan:* | *150 Watts @ 120 VAC (red wire)* |
| *Operation:* | *120VAC +- 10% 50/60 hz* |

AirCycler®
www.AirCycler.com

AirCycler a Division of Lipdex Corporation
411 Plain Street, Marshfield, MA 02050

***Take Control of the Bathroom Fan:*** *Light Switch, Bath Fan Switch, Fan Delay Timer & Ventilation Controller ... All in a Single Switch!*

- ***Make standard bath fans ASHRE 62.2 compliant***
- ***Microprocessor technology provides precise ventilation times.***
- ***Manual fan operation is subtracted from set ventilation time.***
- ***Fan runs every hour for set ventilation, less any manual and delay operation.***
- ***Excess manual and/or delay operation is subtracted from next hours ventilation time.***
- ***Great for - Meeting ventilation codes, Reducing Mold, Mildew & Pollutants, Saving energy and you money!***

The new *Smart***Exhaust**™, from the same people who brought you the ***AirCycler*** line of ventilation controllers, introduces a simple, smart, flexible and economic solution for exhaust ventilation requirements.

The *Smart***Exhaust**™ is designed as a replacement for the bathroom fan and light switch. By using a microprocessor to monitor and control fan operation, a precise amount of ventilation can be provided.

***Switch On: Light & Fan turn on... Switch Off: Light turns off, Fan remains on for set delay time. Off-On-Off fan goes off.***

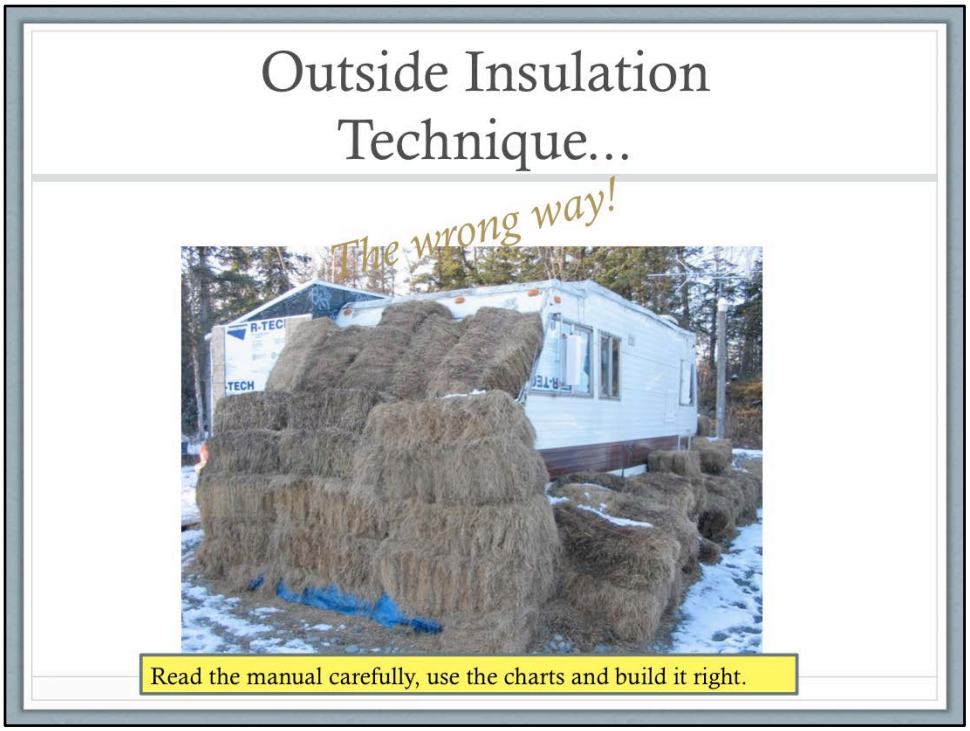
There are only two settings on the *Smart***Exhaust**™ switch - ***Ventilation*** and ***Delay***. Ventilation is the minutes per hour that you want the fan to operate. Delay is the number of minutes you want the fan to run after the bathroom light has been turned off. The Delay time provides additional run time of the fan to complete ventilating the bathroom after use. The *Smart***Exhaust**™ is so smart, you can tell it you don't need the fan to run when you leave the bathroom. When you turn off the light, turn it back on then back off again within a few seconds it tells the *Smart***Exhaust**™ you don't want the fan to continue running.

Since you are substituting an existing switch, or maybe even two, there are no additional labor costs to the *Smart***Exhaust**™ installation. With the light and fan being the same switch, the ventilation strategy can't be defeated.

**For more information call:**
**1-877-FAN-CONTROL**
**(1-877-326-2668)**
**www.aircycler.com**

***It's simple, it's smart, It's easy...***
***The Most Economical Ventilation Solution!***

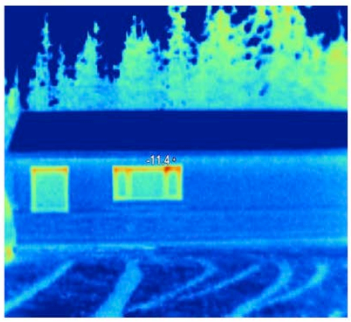
*Patent Pending. Cover plate not included. Use any standard switch plate.*



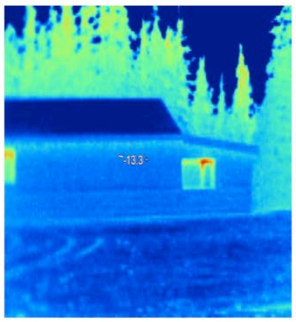

Read the manual carefully and use the charts and do it the right way.

# Exterior IR view at -15

HRV not installed, window open in kitchen



Add-on connection, wall, foundation and roof show little heat loss

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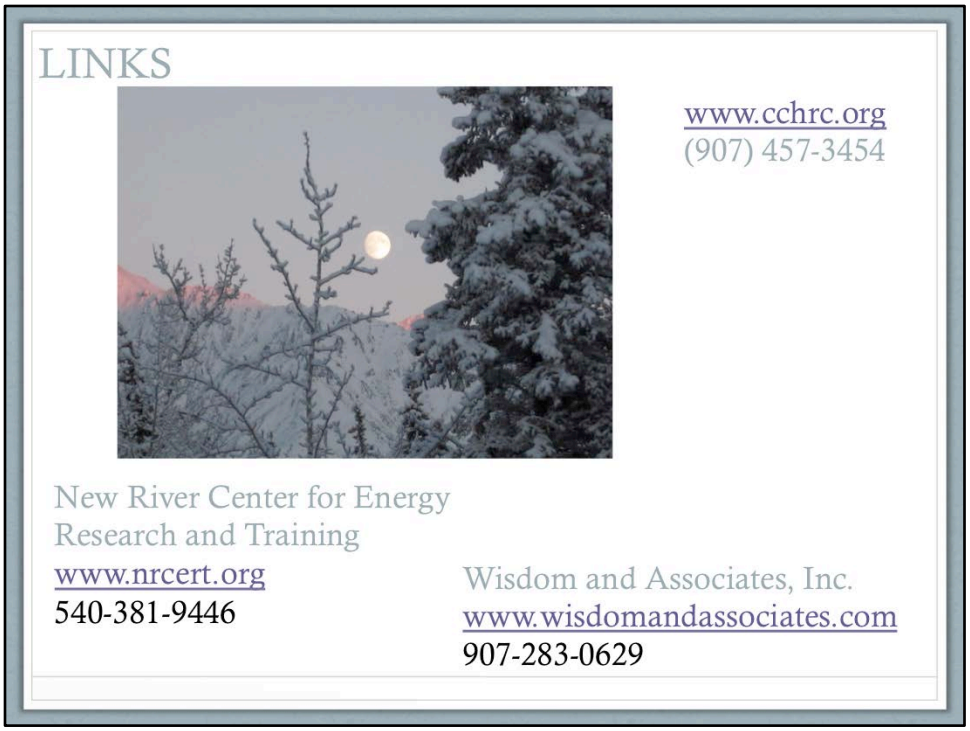


LINKS
Wisdom and Associates: Thanks for the charts, please check out their website it has a wealth of information.
CCHRC.org for more information. Special thanks to Anthony Cox and the New River Center for Energy Research and Training.