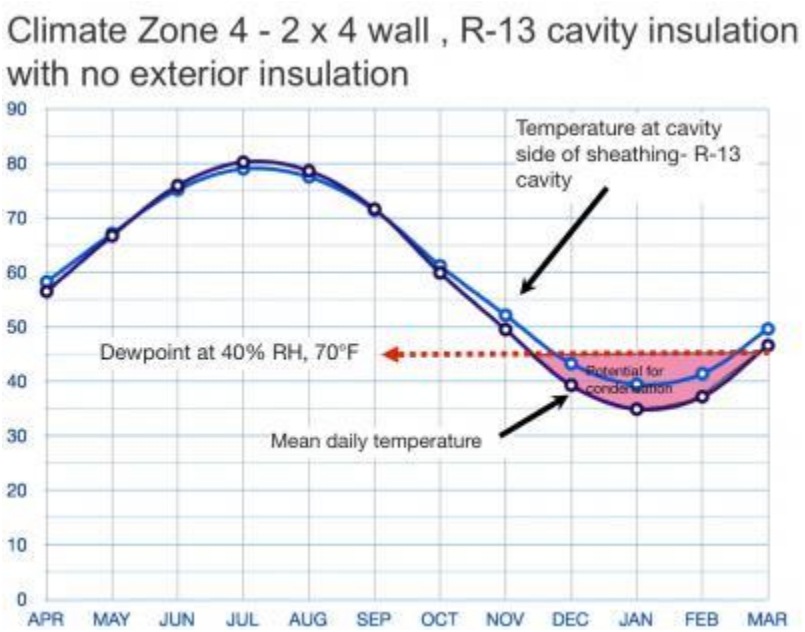
Inside the Slide: Dew Point in a Wall



Here's a slide that we use in a lot of our presentations. As energy codes get more stringent, adding exterior wall insulation becomes a reality for more builders. So when does it make sense to add exterior insulation, and when can you skip it? This example is for a 2 x 4 wall in climate zone 4*.

- *The perception:* When you insulate a wall, it reduces the heating and cooling costs of a building. It will also make the building more comfortable (hopefully)

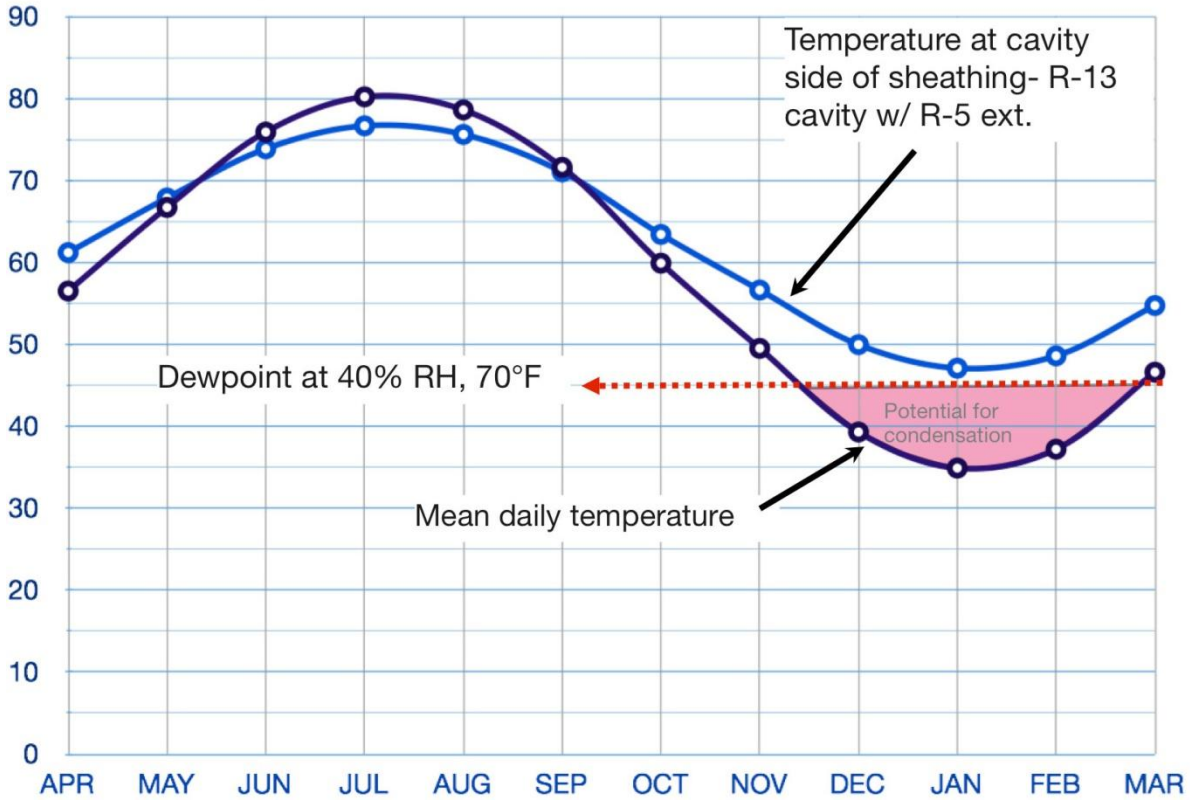
- *The reality:* Many walls have too little insulation and too many leaks. This means that warm moist air can get in, find a cool surface, and condense. Result: The wall gets wet, mold and mildew begin to grow.

- *The data:* This graph illustrates when the potential for condensation can occur inside a wall cavity with no exterior insulation. The dark blue line represents the mean daily temperate in climate zone 4 and the light blue line represents the temperature of the inside of the wall sheathing (back side of sheathing). Safe conditions (no condensation danger) are the times when the light blue line is above the pink zone. As we can see, from November through March, there is potential for condensation. Almost half the year, moisture could be collecting in the wall cavity, condensing and accumulating liquid water in the wall cavity.

When warm moist air comes in contact with cold surfaces, condensation occurs — often with very serious consequences. Air leaks from the inside can carry moisture that condenses on the structural sheathing causing an elevated moisture content and possibly liquid moisture accumulation that could lead to rot and deterioration. This problem can be avoided by adding exterior insulation which can keep the wall sheathing warm enough to stay above the dew point. When the inside of a building is heated to 70 degrees on a 35 degree day and the air inside is 35% relative humidity, the dew point (the point when moisture vapor condenses into liquid) is 41 degrees. So if that moist air hits a surface that is below 41 degrees, the moisture will condense into liquid.

This warm, moist air is driven through holes or cracks in the walls (around electrical boxes, under the gap at the base of the drywall to plate, interior partition intersections, etc.) by air pressures developed from wind, stack effect, or mechanical equipment. The moist air travels through the gaps, through the permeable insulation materials and through holes and inconsistencies in the exterior air barrier and sometimes condenses on the backside of the sheathing increasing wood moisture content above a safe level. In some cases liquid water accumulates in the cavity.

The second slide illustrates graphically the same conditions as the previous slide, but with exterior insulation added to the wall. It is still 70 degrees, 40% RH inside with a 45 F dewpoint, and 35 degrees outside.



The exterior insulation increases the temperature of the sheathing to 47.16 F, which is higher than the dew point of 45 degrees. This means that the water vapor will not condense inside the wall cavity. It remains suspended in air.

- ***The solution:*** boost the R value your walls by adding a layer of continuous exterior insulation. How much exterior insulation depends on the climate zone in which you live, but the 2009 and 2012 International Energy Conservation Code has guidelines worth following — especially if your jurisdiction has already adopted it!
- ***The source:*** Ci Labs, Justin Wilson

*Climate zones matter when considering wall types and insulation strategies. Please don't take this as a road map for all houses.