

## Thermal bridging

BY MARTIN HOLLADAY

**O**n pp. 48-53, Jefferson Kolle takes an in-depth look at the Passive House standard. Houses certified by the Passive House Institute are so tight and so well insulated that they use 90% less energy than code-built homes. Many design practices must be included when building such a high-performance home. One requirement is significantly reducing thermal bridging, which is a major cause of heat loss. Before you reduce thermal bridging, though, you need to understand it. Here's how it works.

### THERMAL BRIDGING REDUCES THE EFFECTIVENESS OF INSULATION

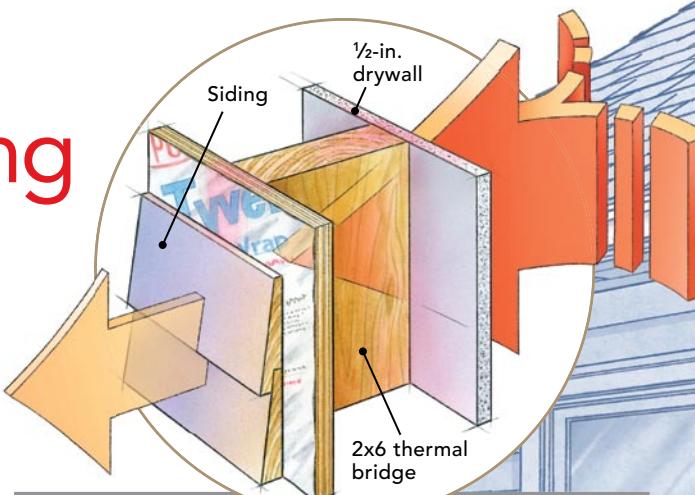
In a typical stick-frame house, lumber occupies 27% of the wall area, leaving little room for insulation. Since the insulating value of softwood lumber (R-1.25 per in.) is less than that of fiberglass or cellulose insulation (R-3.6 per in.), each stick of wood lowers the wall's overall R-value. Each piece of framing lumber acts as a thermal bridge, a conduit for heat to leak through the wall. Thermal bridging is more significant than many realize.

For example, you would think that a 2x6 wall insulated with R-19 fiberglass batts would have an overall R-value of 19. But according to hot-box measurements made by researchers at the Oak Ridge National Laboratory, the whole-wall R-value of such an assembly is actually R-12.8 if the batts are installed perfectly, and only R-11 if the batts are installed poorly.

Thermal bridging can occur in other parts of a house as well. Cathedral-ceiling rafters, window frames, uninsulated slab edges, and masonry chimneys all can serve as thermal bridges.

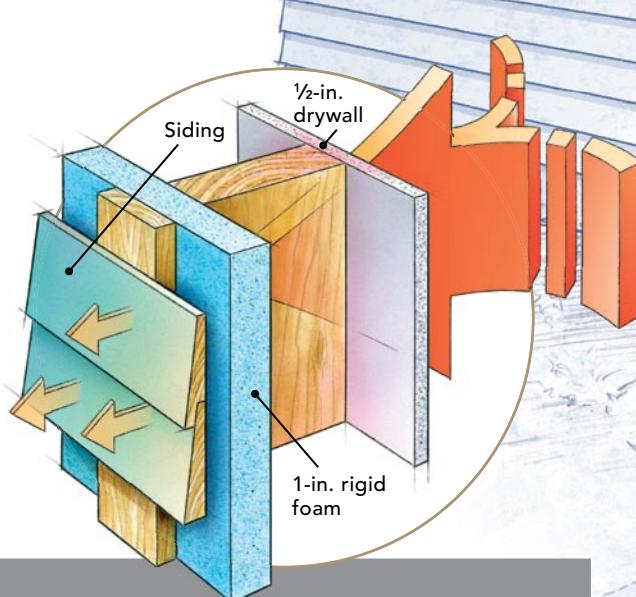
Energy losses are not the only concern. Thermal bridging creates cold spots on walls and ceilings, and can encourage interior condensation that contributes to moisture and mold problems.

Martin Holladay is a senior editor at GreenBuildingAdvisor.com



### THE FLAW IN A CONVENTIONAL WALL

Studs are the weak thermal link in every framed wall. In the case of a wall cavity, heat travels through building components with a high thermal conductivity—framing members like studs, plates, and headers—at a greater rate than through building components with a low thermal conductivity, like insulation. Because conventional wall assemblies effectively link interior and exterior environments, they contribute to heat loss.



### BREAK THE THERMAL BRIDGE

To limit the amount of thermal bridging taking place in a house, you need to detail the roof, wall, and foundation assemblies correctly. The facing page shows four problem areas in a conventionally framed house. While there are a variety of ways to limit thermal bridging in each area, we've outlined four specific techniques that work well.

