Making the Most of a Siding Replacement Job

by Steve Greenberg

Steve Chalmer

A re-siding project offers a rare opportunity to upgrade a home's air-sealing and insulation

I don't think my client was planning on an energy retrofit when he first talked to me about repairing and repainting the shingle siding on his 120-year-old Massachusetts home. But after crunching some numbers, we decided that re-siding the house with factory-painted fiber-cement siding would be more cost-effective than replacing, prepping, and repainting the severely weathered cedar shingles.

That's when we began to talk about improving the home's energy performance, too. I suggested that we add rigid foam underneath the siding to help eliminate drafts and reduce noise from a nearby highway. To seal the deal, I guaranteed that the new foam would pay for itself in just a few years by lowering his heating bills.

Initial Testing

To find out just how much insulation was in the walls, I scheduled an infrared (IR) camera inspection with the insulation contractor at the beginning of the job (**see Figure 1, page 2**). I knew that the attic had only 6 to 8 inches of cellulose and blown fiberglass insulation, but I was surprised when the IR images showed that there was virtually no wall insulation in most of the house. Once I had explained the test results to the homeowner and gone over the benefits of cellulose wall insulation, convincing him to add it to the scope of work was easy.

I also arranged for blower-door testing to see how leaky the building envelope

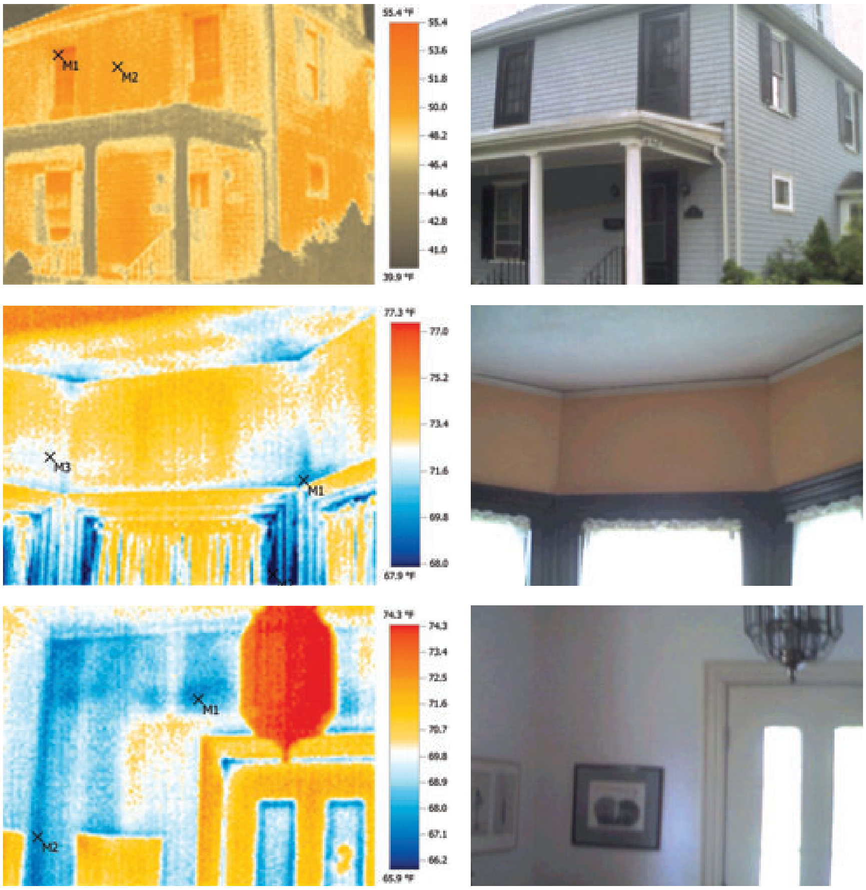

Figure 1. Thermographic imagery revealed empty wall cavities (top), air infiltration around windows (center), and cold spots around framing members like corners and plates (above).

was. To no one's surprise, the drafty house had an air-leakage rate of more than 4,000 cfm50, more than 11 air changes per hour. But what really caught the homeowner's attention was the sight of the curtains on his first-floor bay windows being drawn out nearly horizontally while the fan was running. This prompted him to add six new double-hung sash kits with jamb liners to the project — though I don't ordinarily recommend replacement windows, because they're less effective and more expensive than insulation, with a much longer payback.

Cellulose Insulation

Our insulation sub installed the cellulose at a density of at least 3.5 pounds per cubic foot, giving the walls a solid R-13 or more worth of insulation (**Figure 2**). Though not technically an air barrier, dense-pack cellulose reduces air movement both through and within the wall, which gave us a good head start at air-sealing. After the cellulose was installed, we performed another blower-door test and found that we'd decreased the air-leakage rate to 2,550 cfm50, or about seven air changes per hour. (This wasn't tight enough to

Photos by Steve Chalmer.

Figure 2. The wall cavities were first dense-packed from the outside with blown cellulose insulation (left). Then the crew stripped off the old cedar shingle siding, focusing on one side of the house at a time to protect the exposed walls and insulation from the weather (right).

Figure 3. After removing trim from the old windows (this frame was fitted with new jamb liners and replacement sash), crew members filled voids and gaps around the frames with spray foam (A), then taped the frames to the sheathing with self-adhering flashing tape (B). New cedar sill extensions were applied to the sills (C), while the frames were fitted with new 1³⁄₈-inch-wide Azek jamb extensions (D).

require mechanical ventilation — but we still had the exterior foam to add, so we would need to check again.) The house was also noticeably quieter.

Since it was an unusually rainy summer, we focused on one side of the house at a time when we set up our staging and began stripping shingles. To stay dry when it rained, we hung tarps off the gutters, draped them over the tops of our Alum-a-Pole staging, and staked them out in the yard behind us.

In some areas — such as below windows or where there was blocking — we discovered voids in the cellulose as we stripped off the shingles. In those places we pulled off the exterior 1x12 board sheathing and insulated with fiberglass batts. This was faster and more cost-effective than calling back the insulation sub, especially since we would be installing another blanket of rigid foam anyway.

Unfortunately, I couldn't persuade my client to air-seal the attic or insulate it with additional cellulose, partly because of the cost of removing the floorboards and all the personal items stored up there. But in the future, if energy costs skyrocket, this would be a very cost-effective energy upgrade.

Windows

We filled small voids around the windows — like unneeded sash weight pockets — with spray foam (**Figure 3, page 3**). Then we sealed the window frames to the 1x12 sheathing with 4-inch-wide Grace Vycor window flashing (866/333-3726, na.graceconstruction.com), taping the bottoms and legs first. When we taped across the tops of any windows that were exposed to weather, we used wider 6-inch Vycor and left a 2-inch flap (with the release paper backing still attached) hanging down over the head jamb. Later, when we fastened the jamb extensions to the frames, we folded these flaps back, peeled off the remaining release paper, and attached the flashing to the extension. The flaps act as sheathing-level drip caps that keep water out of the joints between the jamb extensions and head jambs.

We ripped jamb extensions from Azek, a low-maintenance cellular PVC product (877/275-2935, azek.com), making them 1 3/8 inches wide to accommodate the 1-inch-thick rigid foam and 3/8-inch-thick plywood rainscreen battens that would be added to the wall. We fastened the extensions to the jambs with 2 1/2-inch trim nails and welded their corners together with PVC glue.

The sill extensions were ripped from 2x4 cedar. We beveled them to match the angle of the existing sills and made a shallow relief cut on the underside to serve as a drip edge. Then, after applying exterior carpenter's glue, we fastened them to the sills with 3-inch-long screws driven through predrilled countersunk holes. We filled the holes with Abatron two-part epoxy putty (800/445-1754, abatron.com).

Rigid Foam

We wrapped the sheathing with Atlas Energy Shield polyiso foam (800/388-6134, atlasroofing.com), which has a high R-value (R-6 per inch), a low water-absorption rate (less than 1 percent), and a very low perm rating (0.03 for one inch-thick foam). It also has a reflective foil facing that becomes a very effective drainage plane when the seams are taped. However, working with this material when the sun came out was like working in front of a large pizza oven. To keep cool, we tried to stay in the shade or under our tarps as much as possible when it was sunny.

We fastened the rigid foam to the wall with 2-inch galvanized roofing nails, tacking the sheets in place with four or five fasteners per sheet. Since we were hip-deep in scraps of old shingles, we used them instead of aluminum disks as washers for the fasteners.

In this wall assembly, the rigid foam acts as the air and vapor barrier and as the drainage plane, so we took pains to seal the joints carefully. First, we filled in the nooks and crannies and quick-cuts with spray foam (**Figure 4**). Then we taped all of the seams with Atlas WRB flashing tape to continue the air-seal.

At windows and doors, we notched the foam around the sills and butted the boards up to the jamb extensions as best

Figure 4. The walls were wrapped with 1-inch-thick sheets of polyisocyanurate foam, which adds R-6 to the wall assembly and acts as an air and vapor barrier and drainage plane. All joints — including gaps between the rigid foam and jamb extensions — were foamed (far left) and sealed with flashing tape (left).

Figure 5. Battens ripped from ⅜-inch plywood were fastened through the foam and sheathing into the wall framing to provide solid nailing for the fiber-cement siding and create a drying airspace behind it (left). Strips of ⅜-inch-thick Cor-A-Vent installed along the base of the wall between the battens keep out insects (above).

we could. We filled any gaps between the jamb extensions and rigid foam with spray foam, then covered the joints with flashing tape.

At the corners, we taped the sheathing with Vycor before installing the rigid foam, then taped the joints afterward. We also wrapped the exposed bottoms and edges of the sheets with tape (pulling the tape from the back to the front), which should help keep insects from burrowing into the foam.

To find out how effective the foam and tape was in controlling air infiltration, we did one more blower-door test before we started to hang the siding. We found that we had reduced airflow by another 150 cfm to about 2,400 cfm50, or 6.45 ACH50 — still not tight enough to necessitate mechanical ventilation but about as good as we could hope for without air-sealing the attic and foundation. The total wall R-value was now better than R-19, a 30 percent improvement over the dense-packed walls alone, with the added benefit of a thermal break.

Rainscreen

We ripped strips of ⅜-inch PT plywood to use as rainscreen battens (**Figure 5**). Not only will this drying space behind the siding add several years to the paint job, but it allowed us to put up siding during one of the rainiest Junes on record without worrying about trapping moisture underneath.

We located the battens over wall studs and filled the gaps between them along the bottom edge of the house with Cor-A-Vent siding vents (800/837-8368, cor-a-vent.com). The screened vents prevent insects from nesting behind the siding while allowing moisture to drain and air to circulate.

I also wanted to install air gaps at the top of the walls to promote air circulation, but this would have involved tearing into the soffits and wasn't in the budget. Instead, we clad the weathered plywood soffits with prefinished ¼-inch-thick fiber-cement HardieSoffit panels (888/542-7343, jameshardie.com), another low-maintenance product.

Around window and door openings we nailed up ⅜-inch-by-4-inch PT plywood strips, located where they could provide a nail base for the exterior trim. At the corners, we offset 4-inch-wide battens so they would extend past the corner boards and provide nailing for the siding.

Siding

Though we repaired a few rotted windows with epoxy, we replaced most of the window and door casings with 1x5 Azek PVC trim. At the corners, we installed one-piece Azek 5/4x6x6 corner boards, which should do a better job of blocking water than the 5/4x6 fiber-cement trim boards we've used in the past (**Figure 6, page 6**). Besides being very heavy and tough to work with, fiber-cement trim boards have milled edges that make it tough to close up the butt joints on corner boards.

Finally, we installed 5¼-inch HardiePlank fiber-cement siding with a 4-inch exposure. With a single coat of factory-applied paint, HardiePlank has a 15-year finish warranty (a second coat extends the warranty to 25 years). We nailed the siding

Figure 6. Workers trimmed the corners with one-piece Azek PVC corner boards (left). To reduce maintenance costs, the homeowners opted to replace the weathered cedar shingles with new factory-painted fiber-cement lap siding (above).

up with 3-inch stainless-steel ring-shank siding nails, which were long enough to penetrate through the PT plywood and foam into the sheathing and studs. Over the header trim on the windows we nailed standard aluminum window flashing directly to the battens before installing the siding. We caulked between the siding and the trim with Geocel ProColor SWD sealant (800/348-7615, geocelusa.com) color-matched to the HardiePlank.

Performance and Cost

The cost of blowing cellulose into the walls was about $2,300. According to the blower-door testing company's modeling software, the cellulose should save the homeowner $687 per year, paying for itself in a little less than $3\frac{1}{2}$ years before any federal tax credits or local rebates.

Wrapping the walls with rigid foam cost about $2,700. With an estimated annual energy savings based on R-value alone of $167 per year, the payback period for the rigid foam would be about $16\frac{1}{2}$ years — but that calculation doesn't take into account the reduction in air leakage. Overall, the simple payback period for the insulation portion of the project — including six new windows — should be $5\frac{1}{2}$ years; removing the windows from the equation reduces it to a little over four years.

Results. In the year before our insulation project, our client burned 758 gallons of fuel (assuming gallons burned = gallons replaced by delivery). Using climate data from weatherdatadepot.com for reference, I divided 758 by the number of actual heating degree days in that location — 4,317 heating degree days in 2008/2009 — to calculate that he was burning .176 gallon of fuel per heating degree day.

In the heating season after the insulation project there were 3,577 heating degree days. Our client burned 408 gallons of fuel at a rate of .114 gallon per heating degree day, a difference of .06 gallon per heating degree day, or a reduction in oil consumption of 35 percent. Last year, he burned 484 gallons over 3,916 heating degree days, a slightly higher rate of .124 gallon of fuel per heating degree day.

Energy savings are important, and my client is very happy to be saving money. He's also more comfortable in his house and should enjoy reduced energy and maintenance costs for years to come.

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