A Home Office That Works

A pioneering green builder takes on his own home office remodel—and shares what he learned in the process.

This Trex deck—a composite of recycled plastic and wood fiber—offers stunning views from just outside David Johnston's home office. The trellis shades the south-facing windows during the summer.

DAVID JOHNSTON WITH KIM MASTER PHOTOGRAPHY BY POVY KENDAL ATCHISON

From structural insulated panels to engineered wood beams and flooring, David Johnston's home office showcases the best of what's working in nontoxic and resource-efficient building products.

DAVID JOHNSTON'S GREEN REMODELING TIPS

- **Consider multipurpose spaces**. Rooms with multiple functions are more adaptable.
- **Consider "green" financing.** Contact a local professional who's familiar with financing green, energy-efficient renovations. For information, go to DreamSource Financial.com.
- **Establish good relationships with contractors.** In the remodeling industry, relationships can determine the quality of your project.
- **Reuse onsite resources.** Reusing local stone saves the cost and energy of buying new patio materials.
- **Schedule extra time to do the job well.** When working with a variety of trade contractors, there will be times when you're subject to other people's schedules. It can sometimes make the time allotted for your job unrealistic. Scheduling too much in too small a time frame will inevitably stress you and everyone around you.
- **Work out details in advance.** When serving as your own general contractor, it's vital to develop the working ground rules with trade contractors *before* starting work. When will they start? How long will it take to finish? What happens when they uncover unforeseeable impediments? How much is their time and material worth? The more detailed the contractual understanding, the less opportunity for unpleasant negotiations at the end of the job.

When my wife and I first considered buying our Boulder, Colorado, house ten years ago, we climbed up on the garage roof and fantasized about putting an office there. This was going to be the "world headquarters" of What's Working, my environmental construction consulting company, so it had to be the best example of what *is* working. I wanted unique architecture that would blend into my mountain neighborhood, a playful space for working and entertaining, and a room big enough for presentations and meetings. Additionally, it had to be nontoxic and energy and resource efficient.

My architect, George Watt, helped me flesh out a final design that accomplished all of our objectives. My motivations for using environmentally sensitive materials were twofold. First, I train builders, architects, and remodelers to build green. This was my chance to gain practical experience with more products. Second, I developed the Boulder Green Points program and counsel many builders on complying with the program's energy-efficient, resourceful, and healthy material requirements. I often hear builder complaints: "The products are too expensive," "I can't get my subs to use them," or "I can't find the products." Using green materials for my own office addition helped me address these issues firsthand.

I was shocked, however, when I got the contractors' bids,—$200 per square foot, twice my budget! My remodel specifications freaked out even those I'd trained through the Boulder Green Remodeling program because they'd never used materials such as structural insulated panels. I bit the bullet and chose to be my own general contractor.

CUSTOMIZE FOR YOUR CLIMATE

Energy in your home has to be designed as a system. Whether or not you think about it, your home is always interacting with the environment. Hot, sunny days create one response from your home's cooling system; cold, snowy days create a totally different response. By consciously questioning your environment (When does the sun rise? What rooms does the sun shine into and when? In what direction does the wind blow in different seasons?), you create design requirements that are more efficient than automated systems because they're in tune with your specific environment.

Photo by Kim Master

Recycling the Roof The garage's thirty-year-old siding was cedar plywood, and the roof was cedar shakes—tinder waiting for a match, especially in our mountain setting. So, as the garage roof was taken apart piece by piece to make way for a second floor, we saved the shingles as tinder for the wood stove. We deconstructed the plywood roof sheathing and sold it at a recycled building materials outlet, and we saved some of the plywood to sheath the new garage walls.

Flagstones Each time the earth-moving equipment unearthed flat stones, I asked the laborers to pick them out of the pile and stack them for later reuse. Reclaimed stone from all over the property became the flagstone patios around the house and the new office.

Structural Insulated Panels (SIPs) SIPs—framing materials made by sandwiching expanded polystyrene (Styrofoam) insulation between two pieces of engineered wood (OSB)—are a building product of the future. Of all the foams, expanded polystyrene is the least toxic to the environment because it uses steam or pentane to expand the foam pellets rather than ozone-depleting gases such as chlorofluorocarbons (CFCs) or hydrochlorofluorocarbons (HCFCs).

SIPs are energy efficient because very little wood spans from the inside of the structure to the outside, a feature known as thermal bridging. SIPs create a structure that's better insulated and therefore cheaper to heat and cool than conventional framing.

I chose a SIP manufacturer in British Columbia because it "dry builds" the entire structure inside its warehouse to make sure all the panels fit perfectly. One of the downsides of working with SIPs is that it's a real pain when they don't fit together; you end up cutting the panels with a chain saw, resulting in a less-than-perfect fit. (Structural Insulated Panel Association: SIPS.org)

Roofing Oriented strand board (OSB) isn't the most water-resistant material; therefore, I had to make sure the roof sheathing was totally protected. Typically, an elastomeric membrane such as Ice and Water Shield is used only on "valleys" (where two roof planes come together) or on overhangs where ice dams may build up and allow water to get under the shingles. Because SIPs can be damaged by water, however, I covered the entire roof with the membrane. (Grace Ice and Water Shield: Na.GraceConstruction.com)

We covered the membrane with fifty-year-rated composition asphalt/fiberglass shingles, which proved to have the best durability for the best price. These shingles resist hail and strong winds; moreover, they're easily removed if I decide to replace them with solar panels. (CertainTeed Composition Shingles: CertainTeed.com)

Exterior Siding The oriented strand board (OSB) on the SIPs' exterior doesn't leak air, and the panels were caulked meticulously when they came together, so I didn't need a house wrap such as Tyvek but concentrated instead on how to keep moisture away from the not-so-waterproof OSB. The roof overhangs protect the OSB siding to some extent, but I also wrapped the walls in thirty-pound felt paper. We tacked the felt to the bottom of the exterior wall and worked up, mimicking the way a fish's scales are layered so water runs off them. We took extra precaution at the corners and penetrations that are more vulnerable to water. (Oriented Strand Board: OSBguide.com/osb.html; American Saturated Felt: ASfelt.com)

Hardie Panel I hired a siding company to install James Hardie Panel, a fire-resistant siding made from fiber cement that comes in four-by-eight-foot sheets with a stucco pattern. We put two-by-fours over each of the seams in the James Hardie Panel siding, creating a wood trim pattern that echoes the overall building architecture. The top surface of each two-by-four is beveled like a windowsill so water will run off and away from the building. (James Hardie: JamesHardie.com)

Decking Our office's architectural crowning glory is the deck and trellis on the south side. It has the best view, and it shades the south-facing glass in the summer, keeping the building cool.

My decking material of choice was a composite of wood fiber and recycled plastic—my solution to the existential angst in the grocery line when I'm asked, "Paper or plastic?" I still can't answer that question, but I used the recycled bags for my decking. (Trex composite decking: Trex.com)

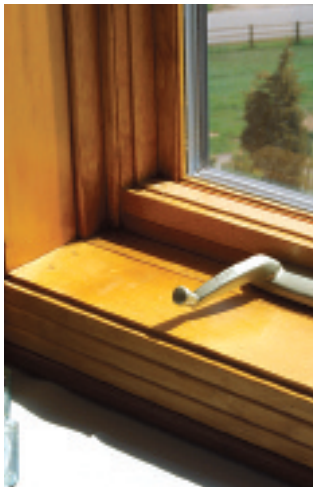
Engineered Wood Beams The addition's large, open architecture required seven-by-fourteen-inch beams for both support and decorative purposes. To avoid cutting old-growth trees—generally required for beams that size—we used an engineered wood called Parallam, or parallel laminated lumber, made from cellulose stripped from aspen trees. Stronger than pine or fir beams, the Parallam beams add a bold architectural accent. (Parallam Beams: USglu-lam.com)

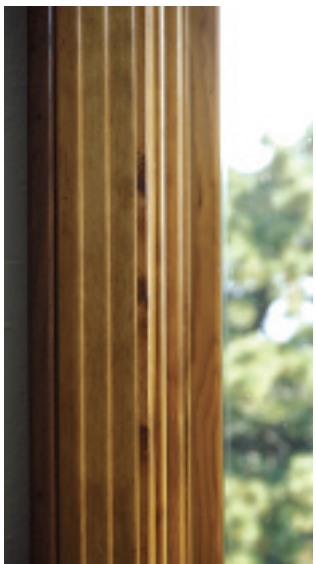
Windows I wanted the addition to be as bright and energy efficient as possible, so I chose low emissivity (low-E) windows with specific solar heat gain coefficients (SHGC). I used low-SHGC windows for the east and west walls (where it tends to be hottest) and high-SHGC on the south-facing glass to maximize solar heat gain in winter. The roof overhangs that block unwanted sun in summer don't obstruct winter light because the sun is lower on the horizon during the cold months.

I installed Heat Mirror insulating glass for all the windows that don't move or open. The downside of Heat Mirror is it requires a metal spacer between the panes of glass because of the tension of the plastic film; the spacer tends to lose heat through conduction. To counter the transfer of heat through the metal, I buried the spacer in the wood trim. (Heat Mirror: AlpenInc.com)

Interior Trim For highlight trim, I installed Forest Stewardship Council (FSC)-certified ipê, a tropical hardwood from South America. When oiled, ipê looks like a cross between teak and walnut—it's beautiful for baseboards, accents around window and door casing, and as edging around the old reclaimed doors I used as desks and cabinets. (Forest Stewardship Council: FSC.org)

Flooring My wife and I installed InterfaceFlor carpet tiles ourselves; it took just a few hours because they incorporate a peel-and-stick process for attaching to the subfloor. Not only is the carpet 100 percent recycled content, but the nineteen-inch square tiles also come in many colors and patterns. The carpet tiles allow for flexibility; if I ever need to run electrical lines and plumbing through the floor, I can pick up only the ones I need to get the work done. (InterfaceFlor: InterfaceFlor.com)





Heating I used radiant hot water heat in the floor—an easy decision but a challenge to execute. Radiant floors are created by laying tubing in serpentine coils covered by lightweight concrete (gypcrete) and wood, carpet, or tile. I didn't have enough room from the floor height to the bottom of the doors and windows to pour the gypcrete, and I didn't want to use baseboard radiators because filing cabinets and desks would cover many of the walls and reduce the heaters' effectiveness. So I found a product called Warmboard, made of 0.875-inch-thick, high-density OSB, which is specially grooved for the tubing to run through. I laid the Warmboard on top of the floor and filled in the rest of the floor with two layers of 7/16-inch-thick OSB sheathing. It left just enough room for carpeting and allows the doors to open. (Warmboard Radiant Subfloor: Warmboard.com)

Water Heating For a heat source, I first considered a tankless water heater that hangs on a wall and is plumbed like a typical water heater but doesn't store water in a tank. Unfortunately, these are expensive and aren't designed for space heating. Instead, I found an efficient A.O. Smith water heater with extra-thick foam insulation around the tank and high-efficiency combustion—it works great! (A.O. Smith water heater: HotWater.com)

Natural Cooling Thanks to natural cooling, the office building works like a charm. We're blessed to be on an east slope so the mountain blocks the summer-afternoon "furnace" sunlight. Large pine trees provide plenty of shade. As wind patterns shift, I open and close the awning and casement windows (placed strategically on each side of the building). Casement windows open like doors, hinged on the side so they can act as wind scoops. Awning windows are hinged on the top and provide ventilation even when it's raining. When the wind isn't blowing, I use a centrally located ceiling fan for air movement. Even when it's been more than 105 degrees Fahrenheit outside, the highest temperature in the office addition was 84 degrees. There's no need for air conditioning with the building doing its job so well. NHG

Adapted with permission from *Green Remodeling: Changing the World One Room at a Time* by David Johnston and Kim Master (New Society, 2004).