

The Path to Becoming a **High-Performance Builder**



It can be daunting.
It can be hard.
It can be deeply rewarding.

Here's how one Oregon crew made responsible, efficient

BY SEAN GROOM

Usually when we talk about cranes on a job site, we mean the large, mechanized lifting vehicles. But tucked away in the walls of a small house in Eugene, Ore., is a flock of origami cranes. Before the insulation and drywall were installed, paper cranes were placed there by the homebuilder, Dave Veldhuizen. He does this on most of the projects his company builds, generally without the owner's knowledge. In Japanese culture, cranes are a traditional symbol of good fortune and longevity.

You might be inclined to roll your eyes at that story and ask, "What do paper birds have to do with building houses?" A lot, as it turns out. The impulse that led Dave to place secret cranes in the shells of houses says a good deal about the way his company, Six Degrees Construction, builds high-performance houses. Namely, it says they care. They care about their clients, they care about their employees, they care about building a legacy with their projects, and they care about the environment. Over the last 14 years, Six Degrees has gone from building well-crafted, code-built houses to its latest project: a LEED Platinum, net-zero house. How did Dave and his business partner, Rick Robertson, accomplish this transition? Nobody starts out building net-zero homes and building them well. Yet Dave and Rick's experience offers lessons that might flatten the learning curve for others interested in building high-performance homes.

Building a legacy

Like many who've studied English in college and art in graduate school, Dave found the appeal of crafting things with his hands stronger than the alleged comforts of an office job, and so he ended up in the trades. He worked for a design/build company in Eugene, beginning as a carpenter and moving on to lead carpenter before handling estimates and contracts. After a decade, he left and founded Six Degrees with his wife, an accountant, in 2001. When their first client asked if Dave would hire his son on the project despite the son's lack of experience, Six Degrees had its first employee, Isaac McCoy-Sulentic, who's still

with the company. Rick, who worked with Dave at the design/build firm, joined Six Degrees as a partner in 2007. Today this small custom residential builder has seven employees in addition to the three owners.

In conversations about craftsmanship, carpenters have told Dave that magazine-quality showcase projects only come along once in a career. With Six Degrees, Dave and Rick have proven that idea false. Since starting the company, they have been able to work on a high-quality "career project" nearly every year. While Dave and Rick say they've been lucky with the types of projects that have come their way, it's also been due to the culture at Six Degrees.

When Dave and Rick use the word *creating* in talking about their projects, they mean it in two ways. First, they mean it with regard to the physical houses they construct, which have a legacy through their craftsmanship and a legacy through the ongoing impact of their resource consumption. Second, they think of creating in terms of the company they are building. They've given a lot of thought to the company itself.

The thing that I found most striking while talking with Dave and Rick wasn't their take on the merits of a particular wall assembly; it was their employment philosophy. They believe that treating their employees well isn't just the right thing to do, but that it makes for better buildings as well. If you hire people because they're passionate and curious and engaging to be around (several employees had no construction experience when they were hired), and if you give them the chance to make a career—meaning a good wage, benefits, education, and interesting work with the chance to hone their craft—you can build quality houses. This is a thread that ties Six Degrees to other exemplary builders known for craftsmanship and environmental stewardship, such as South Mountain Company in Martha's Vineyard, Mass., and Bensonwood in Walpole, N.H.

From timber framing to Passive House

Six Degrees has built a number of timber-framed houses, so crew members are used to framing



construction its core mission.





Because it's a place where employees can make a career, they do.

to tight tolerances. But it wasn't until 2009 that they began to seriously combine their emphasis on craftsmanship with the energy-performance side of building. The McKenzie River house that started them down this road had a staggered-stud wall assembled out of 2x6s on 2x8 plates, and the walls and roof were filled with spray-foam insulation. It was the first house they tested with a blower door, and to Dave's recollection, it was somewhere around 3 air changes per hour at -50 pascals (ACH50). "We were thrilled at the time to get a 3 ACH50 on a two-story house with lots of windows and big doors. Of course, now that scale has changed and we wouldn't be excited with that result, but doing that kind of testing was a big step forward."

Seeing the possibilities, Six Degrees dived into high-performance building. The motivation was environmental: Buildings are big energy users, and Dave and Rick saw the chance on a project-by-project basis to significantly reduce the energy budgets of houses. They have had discussions about whether the company should put a stake in the ground and only build houses that meet exceptionally low energy-use criteria.

They haven't done that. As business owners, they consider it too risky. They've got an obligation to keep their employees busy, and they're uncertain their market would support that stand if the economy slowed down. They also rejected the idea from a green-building standpoint. "Since homes are such a big source of energy use," Rick asks, "is it wise to set a really high standard on the performance level of houses and work on only a few of them? They're often not cheap. Can we have a larger impact on the environment

by building more houses that perform very well? There's a lot to be said about developing a market for those who want to build the right way but can't afford a Passive House."

Since the completion of the McKenzie River house, blower-door testing two to three times during construction, thermal-bridge-free construction, air-sealing, and HRVs have become standard for Six Degrees on new-house projects whether the homeowner is seeking a third-party certification or not. Here's how they've done it.

Educate your employees

Perhaps the thing that has contributed most to Six Degrees' success in building high-performance houses is the company's emphasis on education. During the early years, Dave and Isaac took a two-week-long timber-framing class, and Isaac went to apprentice at the Heartwood School. As the company took on new employees, Six Degrees paid for the whole crew to go to Timber Framers Guild conferences held in the West.

After they completed the McKenzie River project, Dave, Rick, and their key employees started attending building-science conferences, and all employees were sent to conferences such as Passive House Northwest. Dave and Isaac have become Certified Builders and have taken the Certified Passive House Consultant training, both programs administered through the Passive House Institute US (PHIUS). Dave saw it as the best path to a solid background in building science and high-performance construction. Rick is earning his certification as a Sustainable Homes Professional through Earth Advantage.

This emphasis on learning does a couple of things. First, it equips all employees to identify the envelope boundary, to air-seal effectively, and to eliminate thermal bridges. Second, it engages them. Regardless of the certification program a project is enrolled in, there's a target air-leakage number for the crew to meet or beat.

Rick says, "Understanding a home as a whole system that's made up of smaller systems is a steep part of the learning curve. From a management perspective, you do not get buy-in from the guys on the job site just by saying, 'Do it this way.' Because we give them the how and why of it, our guys are invested in the metrics of blower-door-test results, and they know how this contributes to the project goals. As a result, they monitor subs on-site as well as lift the quality of their own work."

One striking characteristic of Six Degrees is the tenure of the guys on the crew. A handful of the seven employees have been there for more than a decade. They're perfectly capable of heading out on their own, but creating a legacy at a company devoted to craft is important to them. And they're working on challenging jobs. Should they start over on their own, there would likely be a lot of bathroom remodels. Dave and Rick also make it enticing to stay. They say they try to pay a leading wage for the area, and they offer health care, a medical stipend, and a SIMPLE IRA. Because it's a place where employees can make a career, they do. As a result, their knowledge, ethos, and craftsmanship stay at Six Degrees.

In addition to professional-certification courses, education comes from more infor-

MOTIVATED BY MILESTONES

The achievements that keep Six Degrees running full tilt are marked by key learning experiences and extraordinary projects that have challenged the company's collective building knowledge and skills. Each has led to growth and helped secure the company's ethos: to build homes that are anchored in the traditions and craftsmanship of the past and grounded in innovations of building science all while remaining fascinated by what the future will hold.

2005

Timber-frame home

Dave and Isaac attended a two-week timber-framing workshop in Colorado on square-rule and scribe timber framing. They then built a square-rule timber-frame home in Eugene, Ore., with two bedrooms and two stories. Six Degrees has since joined the Timber Framers Guild, and employees have participated in several West Coast guild conferences and guild-sponsored workshops.

2007

Appletree home

- Standard 2x6 wall construction
- First time using closed-cell spray-foam insulation

A CAREER PATH IN MOTION

Dave Veldhuizen, the founder of Six Degrees Construction, got his start in the building industry in typical fashion—at the bottom. How he shaped his career path is informative and inspirational for anyone seeking to build better homes while building a sustainable business. Here is a view of his trajectory.

mal sources. With so many new products entering the market for high-performance houses, it takes time to keep up. The builders doing high-performance houses are still small in number, but they've proven to be a great resource and are willing to share what they've learned about products and efficient methods of constructing different assemblies. As an example, Dave points to Portland- and Seattle-based Hammer & Hand, whose website includes a best-practices manual and videos of assembly techniques.

Communicate and collaborate with the architect

One of the first things clients and architects who have worked with Six Degrees mention about Rick and Dave is their communication style. Six Degrees prides itself on being client centered, which seems to boil down to listening, asking questions, admitting what they don't know and then finding the answers, and identifying potential difficulties before they become actual problems. This communication style is well suited to the demands of building high-performance houses.

Dave and Rick both say that it is critical to understand the assembly details in a design, and they are not afraid to ask questions even if it seems they are splitting hairs. The first time they did a staggered-stud wall, Dave remembers a lot of internal debate and investigation of how to actually lay out the wall. "Did 2 ft. o. c. mean 24 in. between each stud, or only between the studs on each side of the



plate?" (Answer: A stud every 12 in. on alternating sides.)

In fact, one of the reasons the architects who have worked with Six Degrees enjoyed their collaboration so much is the fidelity to the design. Of course, architects are pleased that the trim and proportions that they've labored over on the computer are created as they were drawn, but Six Degrees' reluctance to freelance assembly details also means that the house performs as modeled.

- Apprentice with a pro, and immerse yourself in the industry.
- Learn the trade, and work your way through crew ranks.
- Start your own company if your interest and passion compel you to. (Dave started Six Degrees in 2001.)
- Hire your first employees.
- Invest in education; learn and innovate as a team.
- Create a mission statement.
- Commit to creating a legacy with your homes and your company.
- Hire caring people, and treat them well.
- Hire more employees to increase your build capacity. (Rick became an owner of Six Degrees in 2007.)
- Offer employees a career, not just a job. Provide them a good wage, benefits, education, and rewarding work.
- Combine company emphasis on craftsmanship with an emphasis on energy performance.
- Learn from mistakes, and continue to learn and innovate.
- Stay motivated by the work and the environmental responsibilities.
- Develop company construction standards, and stick to them.
- Continue to invest in your employees and their future.
- Grow without compromise.

Reflecting on their work with architects, Dave says, "We really respect what goes into design and what goes into creating a project, and we do everything we can to maintain that. I tell people I'm not the executive chef here; I'm the sous chef. I'm not creating the recipe; I'm putting the ingredients together."

Builders working on their first Passive House or net-zero house typically find that the steepest part of the learning curve is treating the house as a single system. "When

2009

McKenzie River home

- Earth Advantage Silver
- First time building staggered-stud wall assembly and using exterior foam
- First assembly tested with a blower door

2011

Fern Ridge home

- 12-in. double-stud walls with exterior foam, nail base over the roof, and detailed air-sealing strategies
- 2011 PHIUS Certified Passive House Consultant program: Though Dave did not get certified, he went through the training program to gain a better understanding of Passive Houses.

2012

River Road home

- Earth Advantage Platinum
- Built with continuous exterior rigid foam over the roof and walls
- Photovoltaic and solar-thermal collectors included

2013

Fairmount home

- LEED Platinum, net-zero remodel built with Larsen truss walls
- 2014 PHIUS Certified Builder program: Dave was certified through the program, which educates builders on how to successfully construct Passive House projects.



A CASE STUDY IN SUSTAINABLE REMODELING

Mark Gillem, an architecture professor with a practice focused on master planning and urban development, had the idea to remodel his leaky, uninsulated 1917 bungalow as a case study for sustainable remodeling and to use the lessons from his house in his teaching and community-redevelopment roles. Among his goals were net-zero energy use and a dramatic reduction in water use. Six Degrees was hired for the project.

On-site solar panels offset all energy use in the house, including the natural gas used for cooking, hot water, and the fireplace. The first step to achieving net zero, though,

was reducing the amount of energy consumed. The extensive glazing on the front of the house, which captures great westerly views and creates a nearly seamless transition between indoor and outdoor spaces, has a hefty energy penalty. Despite the outstanding performance of the Zola triple-pane R-7 windows and doors (R-3.3 meets the Energy Star qualification for Oregon's climate), Gillem needed to boost the insulation levels in the rest of the house to bring the net-zero target closer. Instead of the R-40 wall typical of a Passive House in his climate, he used 12-in. I-joists to build a Larsen truss on the outside of a

2x6 wall and filled both cavities with dense-pack fiberglass to achieve around R-70.

The distinctive butterfly roof serves three purposes: Its slope is the ideal installation angle for the 13kw photovoltaic array, it hides the panels and two solar-thermal collectors from view, and it serves as a catchment basin for rainwater, which is used for the home's gray-water system. A filtering system cleans the water and stores up to 4500 gal. in cisterns beneath the front porch.

Combined with low-flow fixtures, rainwater harvesting has allowed the Gillems to reduce their city-supplied water consumption by 70%.

Performance specs

- LEED Platinum rating
- Modeled for net-zero energy
- Passive House wall construction: double-stud wall with I-joist Larsen trusses
- Air-sealing verified with 0.8 ACH50 blower-door rating
- Heat-recovery ventilator
- Thermal-bridge-free construction
- Rainwater harvesting (4500 gal. stored and filtered on-site)
- Gray-water system for nonpotable applications within house
- 13kw photovoltaic array
- Solar-thermal hot water
- Triple-glazed windows and exterior doors
- Mechanical blinds to help control thermal gain and loss
- Rain-screen cladding detail
- LED lighting throughout house
- Full energy-monitoring capabilities



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—DAVE VELDHIJZEN



you're building a high-performance house, the details and their execution is important," says Rick. "There is a lot of work, research, and thought in the design of a system, and as the carpenter in the field, you can't avoid a product or a method that you don't particularly like or don't know, because the assembly is a system." For Rick, the line of communication between the guys in the field and the architect is critical. If experience tells you that building a certain detail is going to be a problem, he says, it's best to speak up early.

Dave credits Six Degrees' relationship with architect Jan Fillinger of Studio-e Architecture with helping to push them to move from code-built houses to energy-efficient construction. Jan and Six Degrees have done a half-dozen projects together, including the 2007 Appletree home that included their first steps toward high-performance building, such as using spray-foam insulation throughout the house as an air-sealing strategy. Four years later, they collaborated on the Fern Ridge house, which included many Passive House strategies for a tight envelope free of thermal bridges.

Generally, Dave and Rick have found that clients building a high-performance house are heavily involved and knowledgeable. Six Degrees is a frame-to-finish builder, and having a consistent point of contact for the owners and the crew working throughout the course of the project is paramount.

Get your subs on board

Communication and education extends to all of the trades working on a Six Degrees project. Electricians and plumbers show up ready to cut and drill. They're looking for the path of least resistance. All of the careful attention to air-sealing and maintaining the integrity of the envelope can be undone with an ill-considered hole for pulling wire or running pipe. For Six Degrees, one of the benefits of informed employees is that they can direct subs on the job.

Six Degrees employees can't be everywhere on a project, however. Rick says that as Six Degrees has raised its own level of build-

ing, the company's approach has been to educate the subs it has relationships with in order to bring them along. It's not enough to have a conversation with the owners of the electrical and plumbing companies or their estimators. They may tell their subs, "Don't drill any bigger than needed," and that certain areas are off-limits. If these instructions aren't relayed to those on the site, says Rick, the subs aren't worth working with.

Because Six Degrees works with the same subs from project to project, these electricians, plumbers, and solar installers now know to ask before they drill and cut. Sometimes the Six Degrees project manager will hold a meeting with all of the subs after the house is framed, and each one will be assigned a different color of spray paint. They'll then walk the project and mark their layouts to figure out where the utility runs will go.

Build a relationship with the building inspector

In some municipalities, building inspectors haven't seen Passive House or other high-performance building techniques. For example, during an inspection of a house Six Degrees completed in 2011, the inspector had never seen an HRV and didn't understand why there wasn't a furnace attached. Dave says this isn't because they're lazy or uninterested in new building techniques. When Six Degrees works outside the Eugene city limits in Lane County, there are two inspectors covering an area nearly the size of Connecticut. They've got their hands full conducting inspections and so don't have much time to learn about high-performance building.

To help with the inspection process, Dave has opened lines of communication with building inspectors in the jurisdictions where they work. He schedules time to meet with them and explain some of the techniques and products they're likely to see on their projects. If they're interested, he does a little building-science workshop.

A good relationship with your inspector can also make you a more efficient builder.

One of the challenges of adopting high-performance building methods is finding ways of doing so efficiently. On a recent project, the design called for a two-story gabled wall to be built; because of sheer issues, it had to be balloon-framed with LVL studs in places. With framing, sheathing, air-sealing, exterior rigid foam, a weather-resistive barrier, a rain screen, and siding, there would be a lot of passes over the wall. The most efficient way—and as it turns out, the safest way—for Dave to build all the layers of this wall was flat on the deck instead of scrambling around on ladders and scaffolding.

"I told my inspector what I'd like to do and asked him if I could build the whole thing on the ground and lift it into place," Dave says. "Instead of coming out to do one look at a completely framed project for shear nailing, we were asking him to come out four times to look at our shear nailing. He was willing to work with us and do a series of partial inspections so that we could do this as efficiently as possible, and I'm really appreciative of that. Working efficiently requires getting the inspectors and officials to be on board with us."

Think of the future

Dave and Rick spend a lot of time on their job sites. Dave, in particular, still puts on his tool belt during the framing of most projects. But they've both reached an age where the fact that they won't be doing this forever is something they think about, and they've had discussions of what happens to the business when they step away. They don't have an answer yet, but it seems that the qualities they've used to build high-performance houses—education, communication, craftsmanship, and the idea of building a legacy—are as applicable to building a business as they are to making an origami crane. Each relationship is a fold coming together to make something extraordinary. □

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