Maine's year of the environment | Panelized precision

Green & Healthy HOMES Maine

FALL/WINTER 2020

SECRET TO LOW CARBON HOMES?

It's all in the WOOD

Sustainability & Siding

PLUS+

WORKING GREEN

NEW BUILDING CODES UP THE ANTE

Retail through February, 2020
$5.95
04
7 25274 29097 0

Panelized precision

A high-performance home takes shape in western Maine

A hilltop site overlooking Kezar Lake in western Maine proved the perfect spot for a home assembled from prefabricated parts. Thanks to a 15 kW solar array, the building should generate more power than it consumes on an annual basis.

PHOTOS: KEITH ANDREWS, MAINE VIDEO TOURS, UNLESS OTHERWISE NOTED

BY SCOTT GIBSON

LYMAN SMITH'S mother had a simple request: build a house on land the family owned before too much more time had passed. The hilltop property overlooking Kezar Lake in western Maine had once belonged to Smith's grandmother, and the 18 acres Smith and his mother, Deborah, still held had remained undeveloped for many years. Now, Smith's mother insisted, it was time to build.

Smith approached the project with both joy and trepidation. Joy because he had spent a lot of time on the property as a kid, and trepidation because he suspected that building a house would be prohibitively expensive.

Their plan was to construct a house that needed very little maintenance and one that over the course of a year could produce as much energy with its solar panels as it used – a net-zero house. At the time, Smith and his wife lived in Massachusetts but planned to move to Lovell within a few years and make it their full-time home. In the meantime, the house would be used for vacations and long weekends.

"I wanted a home that was going to be as easy to maintain as possible, and secondly I wanted a home that was going to be as energy efficient as possible," Smith said. "Vinyl siding. Trex decking. Not having to paint the house. I was just trying to think of ways that I wouldn't be spending time maintaining the house and I could just go up there and enjoy it."

Smith and his mother pooled their resources and, before approaching an architect, borrowed some basic design ideas from a cottage Deborah owned on Southport Island. Their new two-story, 2,571-square-foot house would have the living room, dining room, kitchen and master bedroom all on the first floor. The open floor plan would be a near mirror image of Deborah's cottage, using the same basic components arranged in a different way.

Architect Emily Mottram took those ideas and turned them into real plans, and then came the tough part: finding a builder at a price they could afford. Although Smith was reluctant to talk specifics, he said he wasn't prepared for the cost.

"In getting multiple quotes, we were just astounded at how expensive the process was going to be," Smith said. "We could just not fathom how such a home could run this high."

That could have stopped the project in its tracks, except for a chain of events that helped steer Smith and Mottram away from conventional construction and toward panelized construction. Instead of building a house one stick of lumber at a time, Mottram could order wall and floor panels that had been built in a factory. With the help of a crane, they could be put together in a fraction of the time of a site-built house. The process yielded high quality building components and, at least in this case, at a much lower cost than conventional construction.

Bingo.

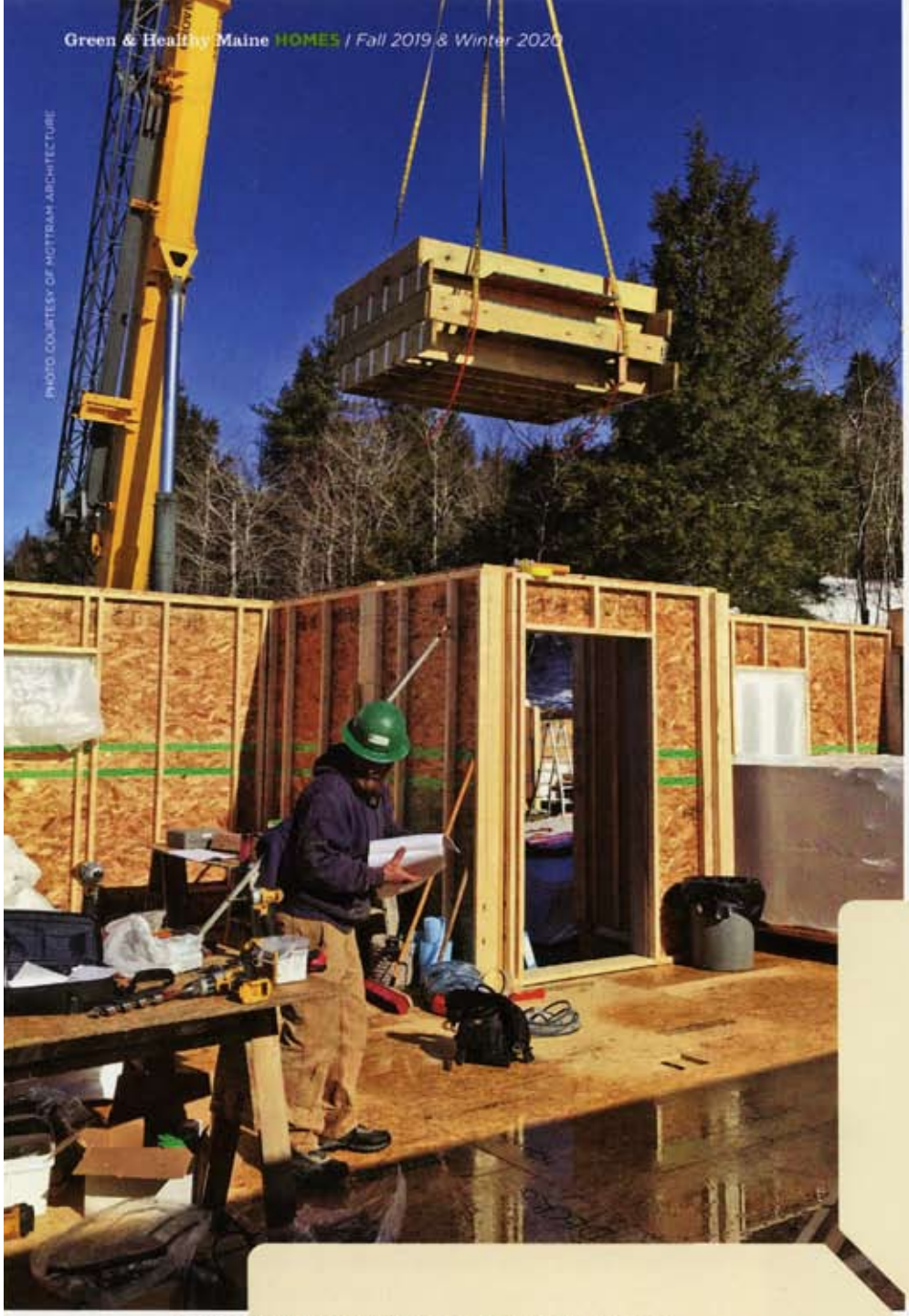

PHOTO COURTESY OF MOTTRAM ARCHITECTURE

Floor and wall panels built at New Hampshire-based Bensonwood were craned into place and assembled in a fraction of the time it would have taken crews to build the house conventionally.

Net positive

EFFICIENCY: 1.4 ACH50

HERS SCORE: -24

SIZE: 2,571 sf, 3 BR, 2.5 Baths

SYSTEMS: Heating and cooling Mitsubishi ductless minisplits; **Hot water**: State Proline heat-pump hybrid; **Solar PV**: 15 kW (grid-tied); **Ventilation**: Broan energy-recovery ventilator (ERV)

BUILDING ENVELOPE: Tektoniks WFB6 wall system: continuous wood fiber board insulation, dense packed cellulose cavity, R-26. **Attic R-value**: 60. **Foundation walls R-value**: 10 **Windows**: Triple-pane Wasco, U-factor 0.133

RIGHT TIME, RIGHT PLACE

For Smith and Mottram, the breakthrough occurred at a conference on air quality that Mottram's frequent collaborator, Patrice Cappelletti, attended in the spring of 2018. Cappelletti, whose company, Live Solar Maine, specializes in high-performance, panelized buildings, had heard about the speaker and was eager to hear him talk.

It was Tedd Benson, a very well-known builder, particularly in New England. He had started in the 1970s by helping to revive the craft of timber framing but in time had branched into other areas. His New Hampshire-based company, Bensonwood, did custom construction, and Benson had come to embrace the possibilities of more automated production. He had developed a line of pre-engineered homes, called Unity, that used panelized parts made on an indoor production line. As Smith was planning his house, Benson was about to peel off another subsidiary called Tektoniks, aimed at people just like Emily Mottram and Patrice Cappelletti – building professionals who needed high-end building components.

"She was nervous to meet him," Mottram said of Cappelletti's approach to Benson after his talk. "But she went up and introduced herself and told him a little about what we were doing. She said she'd like a tour sometime. He called later that week, and said, 'This is Tedd.'"

"It was kind of a right time, right place kind of thing."

It took several months to convert Mottram's original construction drawings from the double-stud wall design she started with to the wall assembly that Tektoniks would build. She settled on what Tektoniks calls the WFB6 assembly, an R-36 panel consisting of a 2x3 service cavity, a layer of structural sheathing, then a 2x6 stud wall insulated with dense-packed cellulose. The outside of the panel is wrapped in a continuous layer of wood fiber insulation made by a German company called Steico.

Once off the production line in Keene, New Hampshire, the panels were trucked to Lovell and put together. Although plumbing, wiring, mechanical systems and other finishes are completed by subcontractors on site,

The house was built on family-owned property with sweeping views of the lake. Now a vacation getaway, it eventually will become the full-time home of its new owners.

an insulated, sealed building shell goes up pretty quickly.

"It was really fascinating, the level of detail," Mottram said, "panels built to a tolerance of 1/32 inch. It was the kind of precision that might be difficult to replicate on a hilltop job site in the middle of winter when carpenters are prying their 2x stock out of the ice."

LOWER COSTS SEALED THE DEAL

Tektoniks makes its pitch on the basis of precision, quality and shorter construction schedules, but at least for Smith the decision to use panelized components also saved a lot of money. He says it knocked roughly one-third off the original quotes he got from conventional builders.

Even Bensonwood found that a little startling. "That's amazing," said Sarah Kossayda, communications director for Bensonwood. The Smith house was, in fact, the first one that rolled off the Tektoniks line.

She said builders using Tektonik components should see savings in the amount of time it takes to complete a building. The shell goes up quickly, and subcontractors should be able to complete their work faster because components are designed to make it easier to install plumbing, wiring and ductwork.

Mottram said it took about five months to finish the house. A time frame of four to six months is realistic, compared with nine to twelve months for conventional stick framing. One sticking point is the long wait for high-performance windows from Europe – adding up to eight to ten weeks.

"Cost is kind of a moving target," she said. "In theory, it should take you a lot less time, so you have a lot less labor ... Panelization is really the future of building, and the more we can have done in their factory, the more cost effective it will get. If they can do plumbing and electrical runs in the factory, that will be good."

TEAM:

ARCHITECT: Mottram Architecture
GENERAL CONTRACTOR: Live Solar Maine
PANELS: Tektoniks (By Unity Homes)
SOLAR: Revision Energy
ERV: The Breathable Home
HEAT PUMPS: Eco Heat Maine

ADDING RENEWABLES

Smith's goal of "absolutely 100% net zero" led to a relatively big solar array, one with a rated capacity of 15 kW. With a connection to the utility's electric grid, Smith will be able

to bank credits for electricity when the panels produce more than the house needs and draw on that credit in winter when the panels can't keep up with demand.

The array is large, but almost everything in the home will be electric. The exceptions are a gas fireplace and a generator. The fireplace is mostly for aesthetics, but it also can provide backup heat if a power loss knocks out the heat pumps.

SOME CAVEATS TO CONSIDER

For a number of reasons, Mottram is enthusiastic about the potential of using prefabricated components to build houses.

The Tektoniks production line turns out high-performance building components in a controlled environment where ice, snow and rain aren't factors. The Lovell, Maine, home was the first to be produced by the Bensonwood subsidiary.

"The future of panelization is huge," she said. "For us it's really key to being female in a male-dominated building industry. There is just so much more opportunity for women and the next generation of contractors when you introduce panelization to the project. The cranes and factory equipment are doing all the heavy lifting, which is the hardest part of building and allows for less dependence on physical labor."

The house is heated and cooled with ductless minisplit heat pumps. Wall-mounted fan units like this one circulate conditioned air.

In Europe, she added, women and older workers are much more common in the construction industry because prefabrication is much more prevalent. With a critical shortage of skilled labor affecting the industry in the U.S., building with prefabricated components could be a big help if it were more widely adopted.

At the same time, she had some suggestions for builders and homeowners who are considering panelization for the first time.

Make sure you know what's included in the contract price and what isn't. In this case, a set of construction stairs didn't come with the house. Small potatoes, maybe, but an unexpected inconvenience just the same.

Be realistic about the site. "You think you know how big a tractor trailer is," she said, "until you realize you also have four guys running it, so now you have four guys and four vehicles and all of a sudden this expansive site you think you had you don't have any more." Drivers delivering panels to the Lovell site had to back down a 1,000-foot-long access road that could be icy.

Be prepared to help your crew learn new skills. Tektoniks sent a supervisor, but it was Cappelletti's team that stood the panels up. That required them to get trained on crane hand signals and send them hunting for the right hardware to hoist the panels off the truck.

"There were some challenges until we got on the same page," she said. "It's still the future of building. Tedd and I have talked about this a lot. You can't get anything inside your home that didn't come from a factory. So why are we still stick-building? Why aren't we pushing building in this direction?" G&HM

Why we like it

Peer review by Robin Tannenbaum, LEED AP, CHA Architecture

THIS PROJECT marries a solid high performance envelope with an exciting new development that could be the future of building; the Tectoniks system allows the architect to bring her/his own design to the table and use offsite panelization exclusively as a construction system. The client gets the benefit of custom site-specific design combined with the precision, time savings and cost savings of panelization. In the state of Maine with an aging workforce, Mottram's realization that panelization can open doors to non-traditional workers could really be a game changer. Kudos to the team for trying a new system and sharing their successes and lessons learned with the rest of us!

Scott Gibson is a freelance writer and editor. He is a contributing writer at *Green Building Advisor* and *Fine Homebuilding* magazine and lives with his wife, Susan, in Portland.