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# Uncharted Waters



Do you ever wonder just how energy efficient you can make your home?

When a couple decided to renovate their New Englander-style home in historic Portsmouth, they asked exactly that question. Never mind that they would already be under the constraints of Portsmouth's Historic District Commission (HDC), which aims to keep homes true to the period in which they were built.

Over a bottle of wine, the couple asked this question of their friend, Bill Southworth, whose company, Elecyr, makes solar-powered "microgrids" for the military and commercial properties. He is passionate about bringing this technology into residential use to create net-zero energy homes, or homes that generate as much energy as they consume in one year. They were receptive to Southworth's vision and decided to hire architect Anne Whitney, who has worked on many neighboring homes and is well versed in the regulations of the HDC.

Whitney steered her new clients toward builders Ethan Korpi and Peter Robie, owners of Eco Sound Builders, specializing in high-performance custom homes. "I like working with them because they know how to efficiently put the whole building together with each aspect working to achieve net zero," Whitney says. "We're not reinventing how to build a building, but we're tweaking a few things to make it all work."

## PAST MEETS FUTURE IN A HISTORIC PORTSMOUTH HOME

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Previous spread, from left: Designer Jeff Osborne created a casual coastal interior with white paneled walls and oiled oak floors. The fabric is easy care Sunbrella. | The kitchen includes custom cabinets by Fred Wildnauer of South Berwick, Maine. | An office is near the master bedroom. | This spread, facing page: The family enjoys water views in the kitchen. | Nautical wallpaper and marble make a stylish bathroom. | A window seat provides extra storage in the library. | The home retains its historic character while solar panels hide on the roof. | This page, above: The renovation includes modern conveniences such as a sauna and gym. | Below: Charles Hugo's landscape design uses plants that require minimal watering, local granite, and a cedar fence that weathers to silvery gray.

With the team in place, construction began in February 2014 and lasted until April 2015. The plan was to take down the previous additions and create a new one. Whitney worked with Boston-based interior designer Jeff Osborne and her clients to create a floor plan that included an open-concept kitchen and family room with an adjacent office and library. The new addition would also contain a gym, sauna, bath, and entryway.

Once the homeowners moved out and demolition began, it was clear that the house was in bad shape. "Basically we had to gut it and take it down to the bare bones: beams, studs, and sheathing," Korpi says.

Nevertheless, the builders kept their net zero goal in mind, providing the house with air sealing, super insulation, and mechanical systems designed to be as efficient as possible before connecting the home to a solar-powered energy system. "The mantra for energy efficiency in high-performance building is 'build it tight, ventilate right,'" Robie says. "Once you can put a value to all those [markers], you can gauge what your energy consumption will be and then figure out how many solar panels you'll need to balance the home to net zero."

Sealing the basement was the first step. The dry-stack rubble foundation was sprayed with foam. The floor was covered with ridged foam insulation, drainage was added, and a concrete slab was poured over it. The challenge with sealing the rest of the house, however, was that they had to maintain all of the traditional details.

"We tore off all the trim and siding," Korpi says. "By removing the overhangs, this allowed for us to make the connections to the exterior insulation package and create a true exterior 'envelope.' Then we were able to rebuild the overhangs to create the original look and feel. This is where Anne's work with the HDC and her expertise really played an important role."

Next, the builders turned their attention to the interior. The home contains a highly efficient heating and cooling system that uses air-sourced heat pumps. Based upon the low heating and cooling load, only one outdoor compressor was needed. Heat pumps remove heat from of the outside air and transfer it to the interior space. "It's basically like having your refrigerator run backwards," Robie says. Since the house is so tight and mechanical ventilation is a must, an energy recovery ventilator (ERV), made by Zehnder, was installed. The unit draws stale air out of the kitchen and bathrooms and brings in fresh air to the bedrooms and other living spaces. The domestic hot water heater works by removing some heat from the basement air. Since a normal wood stove would be starved for combustion air, they used a Scandinavian-style wood stove made in Vermont. The stove is a sealed unit that can be equipped with an outside air combustion kit.

As Korpi worked on the energy system, they ran into two major challenges. "The hardest part was getting the HDC to approve the solar panels," Whitney says. "The only ones you can see are on the garage. The other ones had to be placed on



the back of the house. I had to go all around and take pictures to make sure you couldn't see them from any angle in Portsmouth. We filled half of the roof surface of the garage and part of the roof of the main house with solar panels—ones with a matte finish that look like regular roof panels.”

The second challenge was the lighting system. Southworth's business designed the home's custom lighting system, which features a special controller for the lights and can be run from an iPhone. His company provided more than 100 recessed, low-voltage lights from an Italian company, and Korpi's electrician installed them. Altogether the lights use the same amount of energy as ten 100-watt light bulbs. All 100 lights run off a single outlet in the basement. If building regulations ever change, the system will be able to run directly off the solar batteries.

For all of its state-of-the-art technology, the final product is a home that exudes a clean, relaxed coastal feel. Much of this is due to the homeowners' very intentional selection of natural materials for the interior design. Working with Osborne, they wanted to source local materials wherever possible. “They are casual, easygoing people and wanted everything to feel comfortable and durable,” says Osborne, who chose easy-care outdoor fabrics that look like French linen from Sunbrella and Perennials for the couches and chairs. “If someone spills wine, you can just wipe it up.”

To keep everything light, they selected naturally oiled white oak floors from Vermont Plank Flooring, with a European finish called Rubio Monocoat. Osborne also had white paneling put up throughout the house to make it seem more historic. “It feels like something they might have used in the original home,” he says. He helped the clients make efficient design decisions, choosing recessed shelves over stairways and space-saving pocket doors for the laundry room.

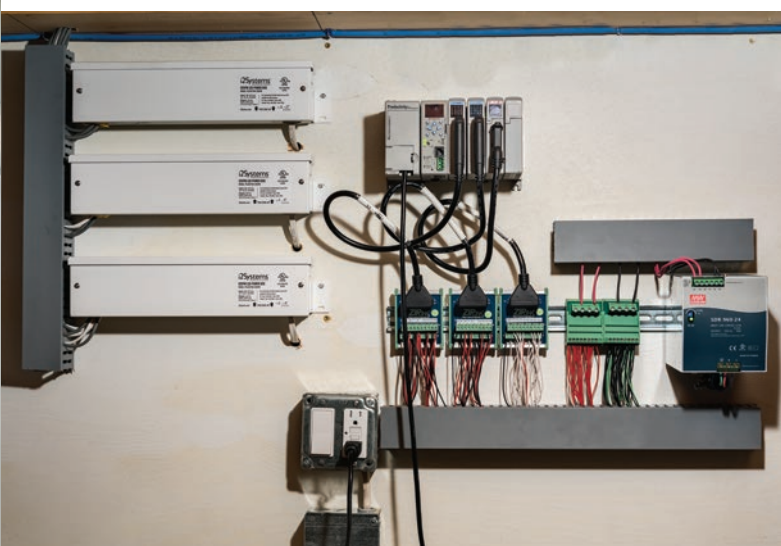
The tile in the bathrooms came from Zenstoneworks in Portsmouth. Cabinets in the kitchen and bathrooms as well as those in the library were done by Fred Wildnauer of F. A.

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This page: Architect Ann Whitney and designer Jeff Osborne used an open floor plan to accommodate easy entertaining. The exposed brick gives instant character to the family room, and the combination of natural materials yields a relaxed, soothing tone to the house. The Scandinavian-style wood stove adds both form and function. Its sleek lines inject a modern touch to the room while providing heat in a tightly sealed space. Artwork by Carol Aronson-Shore and Tom Glover adds color. | Facing page: A transom window was required by the Historic District Commission to stay true to the home's original period. Recessed lighting runs throughout the house and is powered from one outlet.







Wildnauer Woodwork in South Berwick, Maine. For the kitchen, they chose leathered granite countertops, which were installed by Arens Stoneworks of Greenland, New Hampshire, and came from Canada. Arens also supplied the bath countertops, which are marble from Vermont's Danby quarry, the largest underground marble quarry in the world. Even the deck was made with sustainably harvested ash that was thermally modified rather than pressure-treated lumber.

For the landscape and finishing outdoor touches, they turned to Charles C. Hugo Landscape Design. "I was influenced by the couple and their aesthetic. I did a lot of research on European gardens, which keep clean lines to match the architecture," says Hugo, who worked with the clients to achieve a neat and simple look.

Granite terracing, sourced from Maine and New Hampshire, follows the profile of the house and gives the landscape a modern appearance. It took his crew almost five months to complete the extensive stonework. He obtained clear white cedar from midcoast Maine for a privacy fence, which was built and installed by Platinum Fence. The plantings have multi-season interest and focus on a few drought-tolerant, low-maintenance plants: blueberries, lavender, rosemary, thyme, Russian sage, and bearberry.

And then there was the cherry tree, which stood in the yard and was beloved by the neighbors. The builders had to remove it during the renovation, but the neighborhood held a ceremony to honor the tree. Robie and Korpi used some of the wood to make wine racks for the basement and had the rest carved into bowls for the family. It was a passion for sustainability and commitment to nature that fueled this team of homeowners, builders, and designers and led to their remarkable achievement of creating a net-zero home. ■

Facing page, clockwise from above: Layered neutral textiles, a modern headboard, and a painting by Lisa Noonis give the master bedroom a cozy yet contemporary feel. | In one of the five bathrooms, tile from Zenstoneworks creates a spa-like retreat. | Exposed brick in the former attic, now a guest room, brings a sense of charm and history while modern touches such as heated floors warm the odd-shaped space. | Wildnauer also constructed the built-ins in the bedrooms. They had to be carried up a narrow staircase to the second floor. | This page, from the top: Behind the beauty of the house lies cutting edge technology from Elecyr that provides the ability to be a net-zero home. The series of batteries in the garage attic are charged directly from the solar panels on the roof. | Converters in the garage transfer the power from the batteries to the house. | The mechanical ventilation systems in the basement provide the efficiency to keep the home's energy usage as low as possible. Insulated air ducts make them even more efficient. | The plug in the bottom of this photo is responsible for supplying power to all the recessed lighting in the whole house.

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