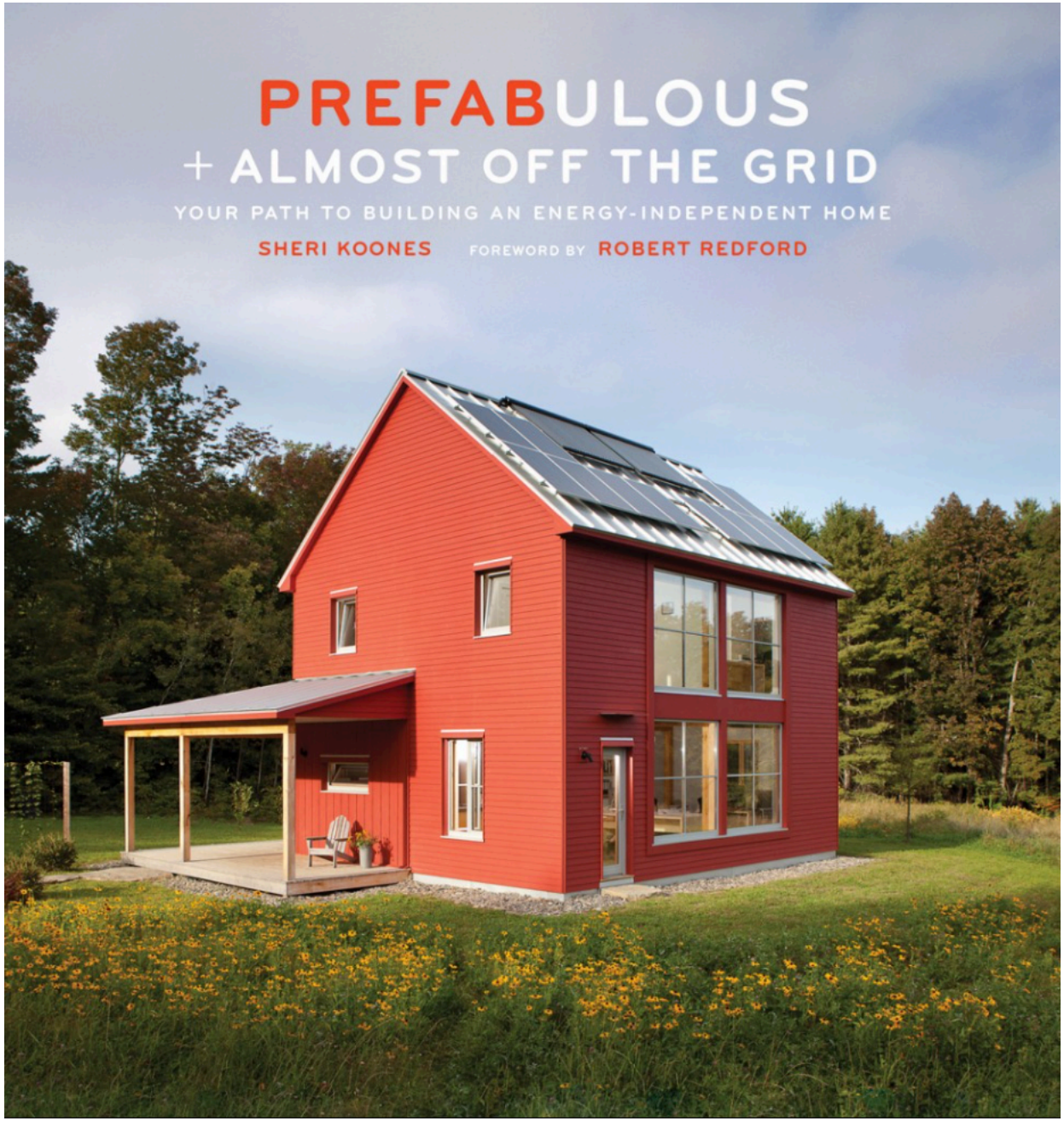
PREFABULOUS
+ ALMOST OFF THE GRID
YOUR PATH TO BUILDING AN ENERGY-INDEPENDENT HOME
SHERI KOONES
FOREWORD BY ROBERT REDFORD

FOREWORD

When I was a teenager working summers as a roustabout in what is now the Chevron Oil fields south of Los Angeles, I got firsthand knowledge of the consequences of offshore drilling. Over the years I've watched the dire consequences it has had on people, wildlife, local fisherman, and other industries. In some cases residents along waterways have relocated because of the oil spills. Imported oil has created other problems, putting our country in a precarious political position.

The recent Chilean mine accident and the nuclear meltdown in Japan have proven that seeking fuel the way we have been can have dangerous and unhealthy consequences. Even "clean-burning" natural gas, the bridge fuel between fossil and sustainable, is highly toxic and polluting in the hydraulic fracturing process necessary to access it.

A perfect solution to this energy challenge is to reduce our dependence on fossil fuel. Over the years clean energy options have become more available, more technologically sophisticated, and more financially feasible. There is new technology available in solar, geothermal, and wind power, and beyond.

In 1975 when I built my own passive solar home in Utah, it was incredibly difficult to find materials and systems to achieve the efficiency and energy independence I sought. Today, these technologies have evolved and there are many options available for the construction of energy-independent homes and other buildings. The variety of systems and the prices for these systems have been reduced over the years. In addition, there are government, state, and local subsidies and tax breaks to encourage their use. Nobody's asking for perfection but even walking down this road partway will go a long way toward a better

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future.

Since homes use approximately 38 percent of the energy in this country, constructing more energy-efficient homes is an excellent way to reduce consumption. *Prefabulous + Almost Off the Grid: Your Path to Building an Energy-Independent Home* demonstrates many examples of houses that require minimal energy; some of which even give back as much energy as they use. The methods and materials used in the construction of houses in this book demonstrate how houses can be built to reduce energy and water consumption, while also being healthy and sustainable. The houses are beautiful, comfortable, and vastly reduce their footprint on the earth.

With the heavy cost we pay for energy—environmentally, politically, and financially—the hope is to embrace the new and reduced cost of natural energy. The houses in this book set an excellent example of the types of houses that should be built today—with reduced energy use, healthy products, and more sustainable materials.

We need to learn from our past mistakes regarding energy consumption and embrace new ways to reduce our needs. It's time for everyone to consider more clean energy options in our lives. *Prefabulous + Almost Off the Grid: Your Path to Building an Energy-Independent Home* will inspire and help you do that.

—Robert Redford
Environmentalist, Actor, Director

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New England Farmhouse

FIRST FLOOR

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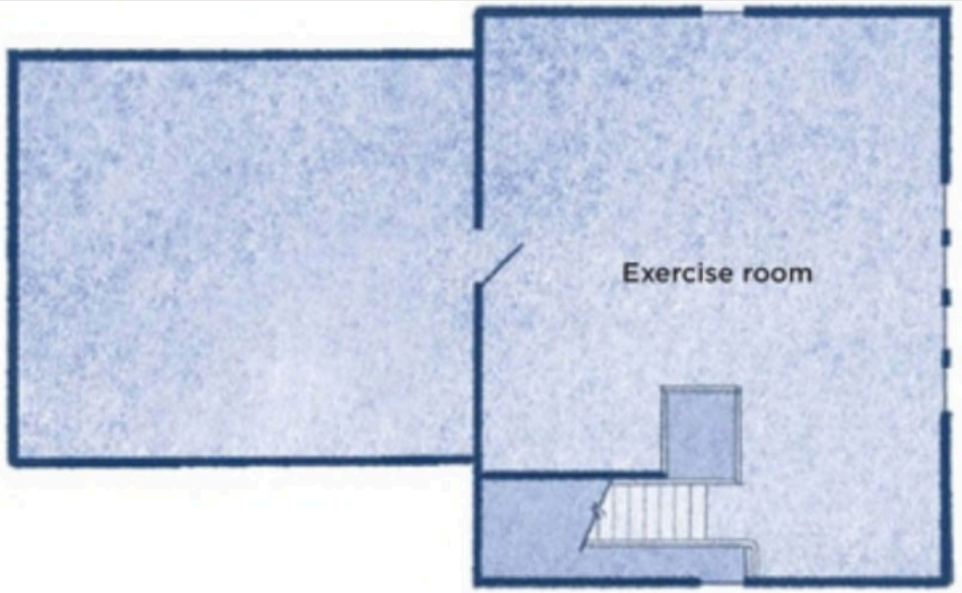

THIRD FLOOR

SECOND FLOOR

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Panelized

PHOTOGRAPHER:

Eric Roth

PROJECT ARCHITECT:

Stephen Haskell, Connor Homes

GREEN ARCHITECT:

Stephanie Horowitz

ZeroEnergy Design

BUILDER:

Aedi Construction

INTERIOR DESIGNER:

Lisa Tharp

LOCATION:

Concord, Massachusetts

SIZE:

2,700 square feet

HERS RATING: 50

CERTIFICATION:

ENERGY STAR

GREEN ASPECTS:

Low-flow faucets

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Dual-flush toilets

Metal roof

Modest footprint

Flexible space

Reclaimed wood flooring

Recycled brick patio

Salvaged kitchen cabinetry

FSC-certified wood

Allergy-free native plantings

No-VOC paints and finishes

HEPA whole-house filtration system

Fiber cement siding

ENERGY ASPECTS:

Spray foam insulation—open cell

Passive solar orientation

Stone flooring (thermal mass)

Interior windows

Daylighting (skylights and clerestory windows)

Ceiling fans

Cooling chimney

Radiant heating and cooling

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High-performance windows

Exterior rigid insulation

ENERGY STAR–rated appliances

ENERGY STAR–rated lighting

Wired for future photovoltaic and solar thermal panels

Heat recovery ventilator (HRV)

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This house, built with cutting-edge green technology, fits in perfectly with the historical neighborhood.

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Lisa Tharp says it has been her mission to exemplify healthier building techniques in her own home and to help others learn about the many healthy options open to them in home construction.

Lisa took time off from her busy interior design practice to build her own house, which became a full-time job. She did a lot of research and made *A Pattern Language* by Christopher Alexander her architectural bible. Published in 1977, this has been an important guide for those interested in building a healthy home. Being chemically sensitive herself, Lisa wanted to be sure that she created a very healthy environment in her own home.

PUTTING TOGETHER A TEAM

She started out by putting together a team of architects who would combine the newest modern techniques of healthy green design and panelization construction with the traditional farmhouse design that would fit into this historical district.

Stephanie Horowitz of ZeroEnergy Design (ZED) worked to combine the green aspects of the house with cutting-edge healthy techniques. Stephanie says, “One of the challenges was to develop a design that captures both the park view at the front of the house and the direct sunlight at the back for passive solar heating and daylighting. The tight, L-shaped lot turned out to be ideal for maximizing the south-facing glazing in the first-floor living spaces.”

Jordan Goldman, the mechanical designer at ZED, also worked on this project. Jordan says, “Two of our biggest design criteria were great energy efficiency and excellent indoor air quality. To reduce the energy demands, we designed an extremely energy-efficient building envelope that is well insulated and airtight. Along with the efficient envelope, we included high-efficiency mechanical equipment to meet the reduced demands in a highly efficient manner. Furthermore, the building envelope is designed to properly manage moisture flow, which eliminates the risk of condensation in the walls, which in turn can cause mildew, mold, and rot. Eliminating mildew and mold is incredibly important for excellent indoor air quality.”

At Connor Homes, designer Steve Haskell was asked to transform the ZeroEnergy concept into a historically credible architectural design. His task was

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all the more challenging because Connor Homes manufactures its houses as precut panel assemblies.

Building the house with panelized construction appealed to Lisa because it is a method of closing a house up quickly and minimizing the intrusion of moisture and mold that can develop when a house is exposed to the elements. Lisa says there was a lot of back-and-forth communication among this team of professionals, but in the end they were the perfect combination of “yin and yang.”

FINDING THE PERFECT LOCATION

The L-shaped lot on which the house was built was carefully selected. After looking at lots for nearly a year, Lisa and her husband, Sam, found the perfect site in historic Concord, Massachusetts, which offered them the lifestyle they sought. The location allowed them to walk to town and spend time in the adjacent park, rather than having to drive everywhere. Their child was also delighted to achieve a new sense of independence as friends, stores, and public transportation are within walking distance.

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The local bluestone in the entranceway matches the exterior front walkway, thereby connecting indoors to out, while providing thermal mass.

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There is more glazing on the rear of the house for passive solar gain and excellent daylighting.

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Why Panelization?

The exterior and interior walls of a house, as well as the roof and floor components, are produced in a factory and then shipped to the site to be assembled together like a jigsaw puzzle. Panels can include windows and doors, but very often are shipped without those items already in place. Because they're built in a controlled environment, these component panels are not exposed to the elements and have less chance of later developing mold. Sophisticated machinery is often used in factories, including Connor Homes', which allows for more precise panels. The New England Farmhouse was erected in seven days, which is much faster than a house can be built on-site.

Indoor Air Pollution: Keeping the Air Clean

Spending time in the home should be a healthy experience—not one that can make you sick. Reports indicate that since people spend approximately 90 percent of their time indoors, they are exposed to two to five times and occasionally up to one hundred times more pollutants than they would be from outside air alone. Indoor air quality has had an adverse effect on many people in their own homes, some suffering from sick building syndrome (SBS), causing acute health problems and discomfort. Those with asthma and chemical sensitivities may be particularly affected by the chemicals and toxins used in building components, paints, finishes, adhesives, upholstery materials, and even the fire retardants and protective coatings used on various items, including mattresses. With houses being built tightly sealed for energy efficiency, these toxic materials are trapped in the home environment. Forced hot air systems can disperse particles around the house and air-conditioning can trap moisture, which may cause mold. More and more houses are being built today with careful consideration of all items used to build, furnish, and clean the house. HVAC systems are being designed to keep indoor pollution to a minimum and maintain a well-ventilated house.

Nontoxic Mattresses

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People might be surprised to find out what chemicals have been used in their mattresses. The Consumer Product Safety Commission requires all mattresses in the United States to contain some sort of flame retardant, which can potentially be toxic. Materials often include boric acid, formaldehyde, and other chemicals that can be toxic to adults and even more so to babies. With most people spending approximately eight hours in their beds each day, exposure to these toxins can have serious health effects. Some people believe that the dangerous effects from the toxic chemicals may outweigh the risk of the mattress catching fire. A doctor's note is required for consumers trying to purchase a chemical-free mattress. One manufacturer offers a removable flame-retardant layer that can be zippered off. White Lotus Home at www.whitelotus.net has an array of choices. For further information about mattress safety, check the website of the Consumer Product Safety Commission and www.peopleforcleanbeds.org.

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The space-saving bed alcove provides a cozy sleeping nook, while leaving most of the square footage in the room available for full use during the day.

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All appliances in the kitchen are ENERGY STAR–rated in order to limit energy use. Larger windows on this southern side of the house flood the interior with sun. Skylights were added for additional daylighting.

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BUILDING "CLEAN"

A great deal of time was spent on research and design before construction began. Lisa scrutinized every item that went into the building and interior design of the house for its health and efficiency.

The building shell contains increased insulation to reduce energy consumption and to maintain a comfortable year-round environment in the home. Building the house airtight limits air and moisture infiltration, avoiding the possible growth of mold and fungus.

Instead of using engineered beams in the floor and roof, which might include toxic finishes and glues, plain lumber was selected. This could have limited the expanse of open areas in the house, but with the combined efforts of the architects, the floor plan was executed to avoid that problem.

Lisa did not want a forced hot air and air-conditioning system, which would keep allergens and other contaminants airborne. Instead she and ZED chose a hot water radiant and radiator system, which would provide quiet, healthy heat.

No-VOC (volatile organic compound) paints and finishes were selected throughout to prevent toxic materials entering the interior air. Lisa says, "Every piece of material that came into the building envelope was evaluated for its toxicity before it entered—from the insulation to the grout to the floor finish to the sofa."

Mattresses (see this page), which in the United States are required by the Consumer Product Safety Commission to contain flame retardants, can be toxic and even carcinogenic. Lisa obtained a doctor's note to purchase flame-retardant-free mattresses, which is the only way they can be obtained in this country. (Canada does not have this requirement.)

All fabrics used in the house are 100 percent cotton or linen, which have not been treated by stain guards, Teflon coatings, or antimicrobial finishes. Lisa says everyone's immune system is affected by some of these chemicals but that those with heightened sensitivities may respond to them faster.

NATURAL VENTILATION

It was very important to Lisa to "work with nature, reducing reliance on mechanical systems." Every floor plan decision was made around the sun, wind, and shade. This excellent team of architects designed the house so that room and window

placement would ensure cross-ventilation and natural sunlight.

An advantage of this lot is the beautiful tall maple trees on the south side of it, which help block out some of the sun in the hot summer. The layout was designed with the kitchen and other family rooms in the rear of the house, where they could take advantage of the solar gain in the winter. The breezes from the open park across the street help to cool the house in the summer.

ZED designed a continuously operating ventilation and filtration system that's composed of a whole-house HEPA filter and an energy recovery ventilator (ERV). The HEPA filter constantly circulates and filters the air while the ERV exhausts stale air from the house and brings fresh air in. The ERV recovers heat and humidity from the exhaust air-stream so that the incoming air is preheated and humidified. This can keep energy loss 90 percent lower than that caused by some ventilation systems.

Steve Haskell at Connor Homes says that in order to take advantage of the solar gain and "daylighting" of the southern exposure, larger windows were used on the rear of the house where the kitchen and family rooms are located. Smaller, more historically correct windows are on the north-facing front. This is the side that is seen from the street.

ACCESSIBLE AND UNIVERSAL

Lisa's major priorities in building her house were to make it comfortable and healthy, but she also wanted the house to be practical for her family's current situation and the future.

The downstairs has a "wet room" bathroom, which is wheelchair accessible, instead of a powder room. On the wall is a showerhead but no enclosure, with the floor pitched to the floor drain. This can be used by someone who is not able to get upstairs to the more conventional showers or it is a good place to wash a dog or clean muddy boots. This bathroom and the study next door could someday be turned into a master suite, so the couple can age in place in the house they have worked so hard to create.

FUTURE ENERGY MEASURES

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ZED provided the infrastructure for future photovoltaic panels and a solar hot water system. These renewable energy systems will allow the house to offset some of its energy consumption. Lisa and Sam may decide to add these systems after they see what their future energy requirements will be.

BLOGGING AS AN AID TO OTHERS

Lisa started a blog (www.concordgreen.blogspot.com) so she could share all that she learned through her research and construction. “This house has become more than just my own health challenge, which I’ve made huge strides in,” says Lisa. “I wanted to learn and then spread the word to help other people so they could be aware of how simple choices that we make when building or redecorating our home can dramatically impact our health.”

The New England Farmhouse is not only healthy but also beautiful and efficient. It is no wonder that Lisa is inspiring others by her construction decisions; through her blog she is also bringing together an entire community of people who are dealing with chemical sensitivity issues similar to her own.

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Tall, south-facing windows capture passive solar energy.

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Instead of a powder room on the lower level, a “wet room” bathroom was installed. The showerhead can be used for showering, but also for washing a pet or muddy boots.

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