Harnessing the Power of the *Sun*

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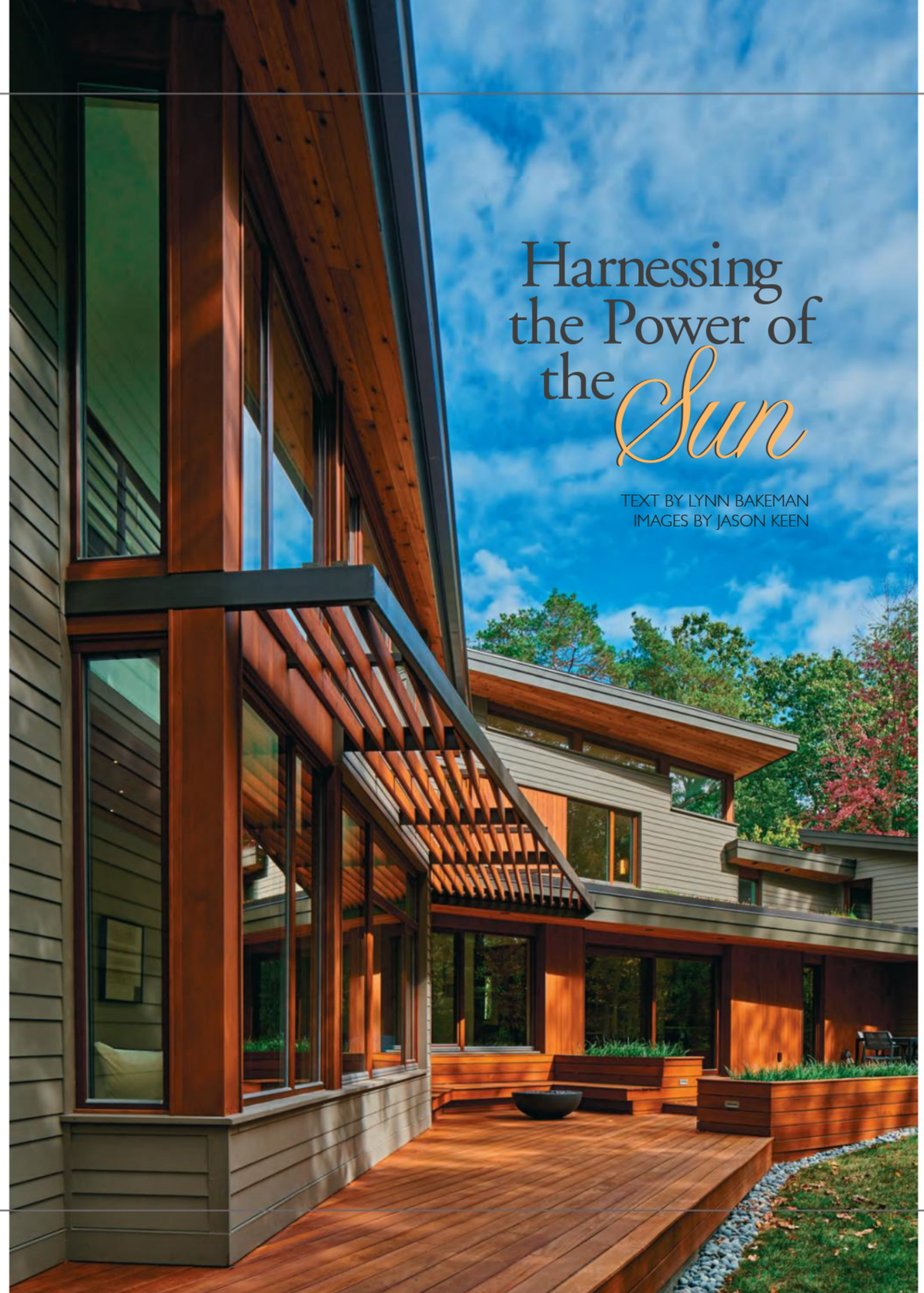
Germany is a global leader in solar power and with weather patterns similar to West Michigan, a properly constructed home can produce 80 percent of its solar energy needs even on an overcast day. The secret is knowing solar orientation and creating architecture that maximizes the power of the sun.

To Evan Mathison, principal and co-founder of Mathison|Mathison Architects (MMA), using sustainable design principles is the driver for the performance of any building and ultimately its form. "We always do sun angle studies on all of our projects and every architect or designer should do this, but many don't," Mathison explained. "I tell our clients that a significant chunk of the budget and often the most expensive part of the house is its windows. Where they're placed, how big they are, and their orientation is one of the most critical decisions."

Mathison became his own, most challenging client when he and his wife designed and built their own home. "It was exciting but we were always second-guessing ourselves," he said. "I hadn't attempted anything of this scale in the role of builder and interior designer and it was intimidating. I have a lot of respect for what they add to a project.

> *But tomorrow may rain, so I'll follow the sun.*
> — The Beatles



"During our architectural design process, our role is to serve as a mediator or stabilizing element between the couple's ideas — the third leg of the stool. I was able to learn how a homeowner working with an architect for the first time would approach a project. When we found ourselves making decisions on how we wanted to live, I had to evaluate the question from an architectural standpoint or design perspective rather than as the client. The third leg of the stool became a virtual one."

Conceptually, their ideas about the house were rooted in modernism, yet they didn't want a radical glass box, but one that felt in context with its neighborhood. Looking at the blank slate: a rectangular, wooded property on a relatively flat one-acre plot; Mathison knew that as an active solar home, its south-facing orientation was critical.

Questions such as how the home would be approached from the street, what trees should be kept or removed, the roof height and overhangs were all considered in light of … well, the light. Mathison explains, "If you picture a standard suburban house with a central corridor and living spaces off the front and back of the house, this home has been pulled apart and living spaces are now end-to-end instead of in front of each other.

"A big source of inspiration to us was the interplay of the vertical canopy of the mature, tall trees on the site with the strong horizontal lines of the house fanning out at a 45 degree angle to fully engage the wooded landscape." This creates private, intimate family space on the inside of the building volumes oriented to the south and southwest.

The north-facing main entrance exposure of the home features only 20 percent of the windows. Step inside the home, and you're drenched in natural light from 500 square feet of glass and the beauty of its design becomes crystal clear.

"A big source of inspiration to us was the interplay of the vertical canopy of the mature, tall trees on the site with the strong horizontal lines of the house fanning out at a 45 degree angle to fully engage the wooded landscape."

Deep overhangs and trellises, as well as the form, shape, and angles of the roof were designed to provide shade when the sun is high in the summer sky. Then, when the sun is lower in the winter and the trees are bare, sunlight is guided deep into every corner of the home.

A series of deep overhangs and trellises, and the form, shape, and angles of the roof are designed to provide shade when the sun is high in the summer, then when it's low in the winter and the leaves are off the trees, the light is guided deep into every corner of the home. Because it is only 16-feet wide, there are no dark or internalized rooms. Every single circulation space is oriented along an outside wall — upstairs and downstairs hallways; mudroom to kitchen to living room — continually borrowing light into the living spaces. There's so much glass and light that during the daytime, they seldom need any lights on. Mathison|Mathison Architects always look at their projects through a sustainable lens and was doing so before sustainability was a thing. "Our approach is based on simple relationships to how we live with natural light and the landscape. We can use high-tech approaches like geothermal or solar panels, or low tech but you'll always end up with a sustainable house. The path of the sun affects the way you live and we're going to think about the placement of glass, walls, overhangs, and shape of the house.

The north-facing, main entrance exposure of the home features only 20 percent of the windows. As an active solar home, the south-facing orientation was critical.

Cedar siding from **Eikenhout** was used on exterior walls, patios, and planters to create a warmer, more intimate feel where people gather. And a western red cedar accent wall was used for high impact at the front entry.

"We'll make the form and shape of the roof actually perform: Making a deep overhang versus the 12-inch standard — by simply using a different truss profile — can dramatically change the way people live and is a low-cost change," Mathison said.

Many clients come to the firm who haven't worked with an architect before. They may bring floorplans which MMA uses as a reference point. They work through a wish-list process, but from a functional use perspective; forcing them to think about what time of day they use each space and how they use it. Frequently, sustainable projects mean building less square footage as the firm is able to economize the floorplan to maximize its flexibility and utilization. Based on the family flow pattern, they're able to create an ideal layout and prioritize costs.

For Deer Haven, they prioritized bullet-proof concrete floors with radiant heat in high traffic areas of the mud room, laundry, and kitchen for their young, active family. Wide-plank walnut floors flow through the rest of the house and Western red cedar accent walls are used for high-impact in the front entry, mud room, owner's suite, and living room.

They minimized costs by using the same materials in different ways which emphasized the relationship of natural light, space, and forms rather than materials. All bathrooms feature the same porcelain tile in different sizes; black on floors, white on walls with grey or white quartz counters.

A knotty cedar wood ceiling cloud spans the entire spine of the main floor from the mud room entry to the living room at the far end. Conceptually, having a natural ceiling above your head echoes the outdoor wood soffit and natural wooded setting beyond. There's 60 randomly placed, 1-watt LED lights integrated flush into this ceiling. At night, it mimics a constellation of stars illuminating the entire circulation path throughout the first floor and is equivalent to using one 60-watt bulb.

The sustainable hero of this home's design and performance is the European-made, tilt-turn, triple-pane windows. This is the first home outside of

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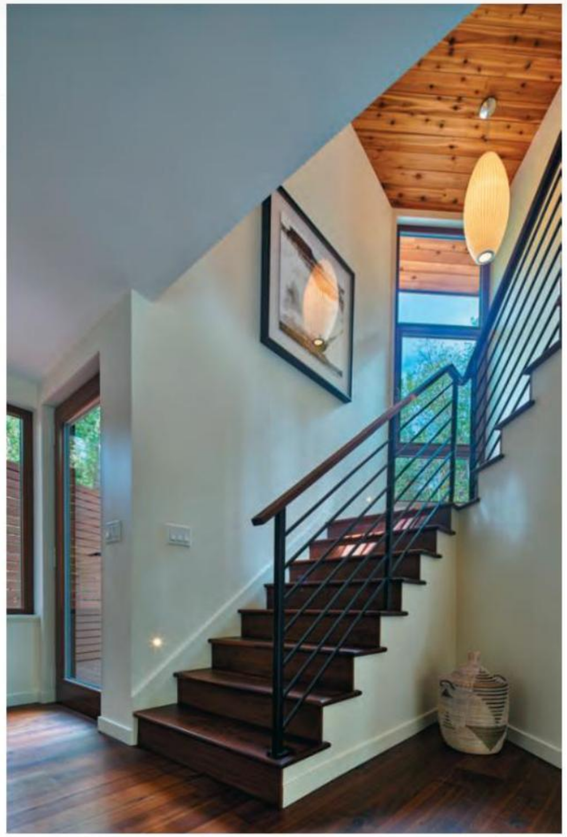
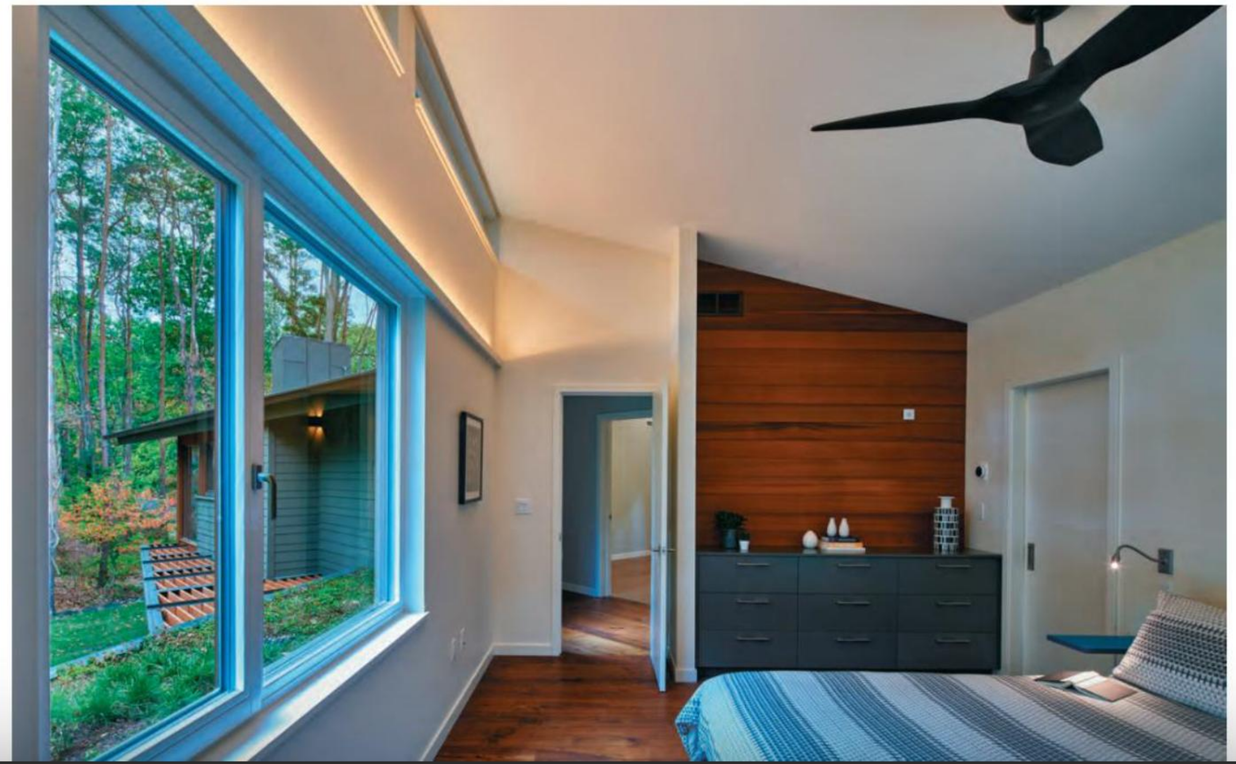
All bathrooms feature porcelain tile in different sizes; black on floors, white on walls with grey or white quartz counters.

European-made, tilt-turn, triple-pane windows provide the ultimate in energy efficiency by virtually eliminating drafts. Standing next to a wall of glass feels similar to standing next to a solid wall.





The public spaces on the main level are organized so occupants will naturally follow the path of the sun throughout the course of the day. Clerestory windows on the north side oppose massive south-facing windows so every part of the home is in full natural light even in the dead of winter. Having a house that is well-lit throughout the year has proven to be mood lifting.

New England that used these and Mathison wanted to show his clients their energy efficiency in operation. More common American double-hung or casement windows have varying levels of quality among manufacturers, and typically suffer from a less effective air seal.

Triple-panes virtually eliminate drafts and standing next to a wall of glass or huge slider feels similar to standing next to a solid wall. Air seal is critical to this project because of the amount of glass used and these windows tilt from the top into the room or fully open to the inside like a door. The quality of the double-seal and the multi-point locking hardware is very high and Mathison is proud to achieve a passive house air sealing rating of .59 air changes per hour. An Energy Recovery Ventilator (ERV) runs almost continually through HEPA filters and keeps 90 percent of the heated or cooled conditioned air in the home.

In the kitchen, a 14-foot wide, two-piece, lift-and-slide door fills the width of the kitchen. An 8-foot window was more important than upper cabinets, so an 8-foot long butler's pantry was added with full cabinetry and serves as a prep

As a combustion-free, all-electric home with no gas lines, the living room fireplace runs off a bioethanol reservoir that's filled annually. A narrow 2 by 30-inch tile surrounds the hearth with a mantle of thin black steel for sleek elegance.

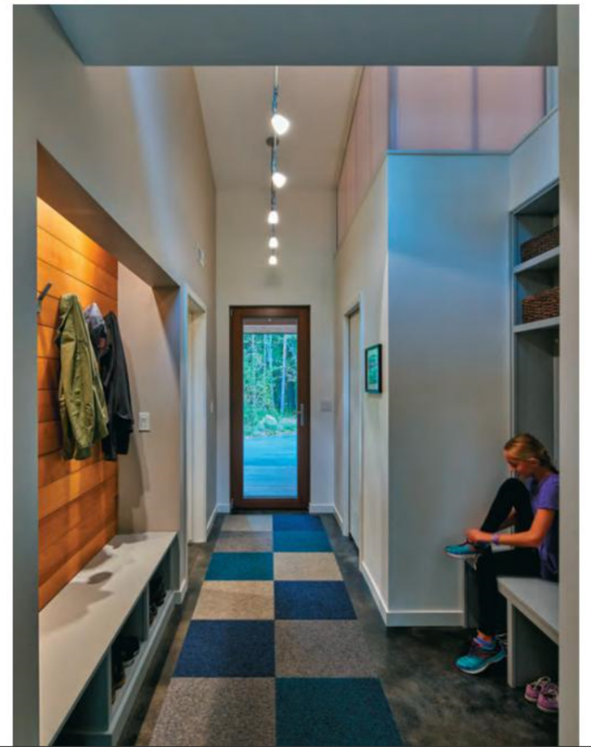
A cedar wood ceiling cloud spans the entire spine of the main floor and includes 60 randomly placed, 1-watt LED lights integrated flush into it. At night, it mimics a constellation of stars illuminating the entire circulation path throughout the first floor and is equivalent to using one 60-watt bulb.

and storage area for small appliances. Simple walnut veneer cabinetry coordinates with the beautiful 42-inch wide, 7-foot long walnut live-edge slab table from an Amish lumberyard in Indiana. An integrated teal blue bench gets the kids involved in food prep. Reflective glass subway tile runs from counter to ceiling and is easy to clean.

The public spaces on the long, narrow main level are organized so occupants will naturally follow the path of the sun throughout the course of the day. Clerestory windows on the north side oppose massive south-facing windows so every part of the home is in full natural light even in the dead of winter. Having a house that is well-lit throughout the year has changed everyone's mood and been transformative for his family.

Running along the south facing wall of the home is an 18-foot long bench with storage drawers filled with puzzles and games. Full of natural light, this is essentially where the kids hang out reading or playing.

This is a combustion-free, all-electric home with no gas lines. The living room fireplace runs off a bioethanol reservoir that's filled annually.



Concrete floors with radiant heat from **Moberg Heating & Air** were utilized in high traffic areas of the mud room, laundry, and kitchen for a young, active family.

Walnut veneer cabinetry from **Woodways** coordinates with the beautiful 7-foot long walnut live-edge slab table. An integrated teal blue bench gets the kids involved in food prep. Reflective glass subway tile runs from counter to ceiling and is easy to clean.

Mathison wanted to avoid a wood-burning hearth that draws out conditioned air leaving other parts of the house to get cold. He used a narrow 2 by 30-inch tile surround with a mantle of thin black steel for sleek elegance.

The house and roof was pre-engineered using a high-performance system of insulated foam panels called Structural Insulated Panels (SIPS). Hardie cement boards were alternately spaced to form an intriguing texture on the siding. Cedar siding was used on exterior walls, patios, and planters to create warmer, more intimate feel where people gather. The sun trellis not only creates an enclosed, intimate outdoor room with integrated bench seating, it provides 90 percent of the shading for the south-facing glass since the deep roof angle above can't provide enough shade at the hottest time of the day and year.

Another example of conscientious sustainability is how the home system recycles to feed one another. Rather than dumping the heated waste water from the geothermal ground loop, it's put in a tank that cycles it into the radiant floors in the concrete portion of the house.

The 5kW solar array produces about half of the home's total electric consumption and is part of a 10-year contract with Consumer's Energy. One meter on the home measures buying energy, and a second meter sells energy back to the company. At the end of the contract, Mathison plans to double the solar to a 10kW panel system and completely cut the home off the grid.

The end result of functioning as all three legs of the stool in building his home was that Mathison had a valuable crash-course in learning the construction landscape of West Michigan. He concludes, "I had to forge relationships and learn to rely on and appreciate the skill of specialty trade and subcontractors through the creation of the house. It was a great way to meet amazing collaborators many who continue to work on other projects in our firm." ■

RESOURCE INDEX

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FURNISHINGS **The Home Studio**
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