



Thermal Inertia

Warm Wood, Convection and a Home that Heats Itself

JAMES ASKEW

The day that Tim and Cheryl Sund left their southern Vermont home to drive northeast to the border of Maine and New Hampshire, the temperature that afternoon had dipped to 14 degrees below zero, with a driving northeast wind and a blinding snow storm. It was one of the worst days of the winter, Tim recalls, and yet it was a near perfect day for what the couple had set out to do. The Sunds are a family of builders. Tim is a carpenter with nearly 40 years of experience. Cheryl maintains the business. And together, with two of their children, Jeremiah and Mathew, the Sund family owns and operates Sund Energy Homes.

This was the winter of 2001-2002. Tim and Cheryl, both then in their mid-40s, had begun lately to think about retirement. Their kids had grown and moved away. The family home had become too big. Tim wanted to sell the house and move south to a warmer climate. Cheryl wanted no such thing. And the kids, for their part, encouraged their parents to stay in Vermont. "Trying to talk my wife into selling the house, with all its memories, was very hard," Tim admits, but eventually they reached a compromise. What the couple needed was a smaller home. What they wanted was a warm and comfortable home that they could easily afford, even after they retired. Winters in Vermont are long, often five months or more, and from December to March, a week of below zero temperatures is not uncommon. For a home to be both comfortable and economical means building to an extreme level of energy efficiency, and that is what the Sunds decided to do. "We finally ended up selling the house," Tim says, "and we were looking to build a green home."

As a builder, Tim knew the available options, and the Sunds considered each. "Back in the 70s," Tim says, "we were

doing earth homes, building them into a bank with the sun at the south side and a dirt roof. And so, I went back and looked at a couple of those, but everybody had added a second story. I talked to one homeowner and he said that it was too depressing, that you wanted to be up above ground."

The Sunds then considered building with structural insulated panels (SIPs), but as Tim admits, he's a bit old fashioned and didn't like the idea of living in such a tightly sealed home. "SIPs make sense to me," he says, "for a totally air-tight house, but to me, you have to filter your air and bring in air, so it's like you're sucking through a straw to live in your house."

It was also around this time that the Sunds read an article about Enertia Homes, a building system developed in the mid-80s by engineer and former log home builder, Michael Sykes. The Enertia Home, produced by Enertia Building Systems, Inc., is a log home kit of glulam logs that lock together with tongue and groove joints. The homes incorporate a basic passive-solar design, with a mass of windows to the south and fewer windows to the north and west, but Sykes took this concept a few steps further. Sykes discovered, as a log-home builder, that large masses of wood, especially Southern Yellow Pine, absorbed a significant amount of radiant energy—such as heat from the sun—and released it slowly over time. It is a process known as thermal inertia, and it explains why log homes, despite having significantly lower R-values (Southern Yellow Pine typically running at about R .91 per inch) are often found to be more energy efficient and more comfortable than a comparable stick-framed house.

The goal was then, Sykes says, "to maximize the amount of pine in the home." At first, Sykes designed and built

THE MORNINGSTAR MODEL 3236, A 2,780-SQUARE-FOOT (INCL. THE BASEMENT) TWO-BEDROOM, TWO-BATH ENERTIA HOME IN CHESTERFIELD, MASSACHUSETTS, IS SHOWN WITH WINTER AND SUMMER CONVECTION DIAGRAM. MORNINGSTAR IS ONE OF 14 KIT HOMES FROM ENERTIA HOME. IMAGES COURTESY OF ENERTIA.COM.

solar log homes, incorporating passive solar techniques into a typical log home design. But, as is often the complaint with passive solar homes, Sykes found that the temperatures varied wildly from one side of the house to the other. Sykes sought to solve this problem and again turned to a number of preexisting ideas. The first was a lesser-known building technique called a double-skin façade, which, in short, involves the construction of two exterior walls on the north and south sides of the building, with an air channel between the two walls. The air in this channel is then circulated, from top to bottom around the building, moving warm air from one side to the other or up and out through a vent near the roof. Sykes found that by using the double-skin façade not only was he able to double the insulation value of the logs and greatly increase the wood mass for thermal inertia, he was also able to achieve a greater temperature balance within the home.

The process by which a double-skin façade works is simple convection. Hot air rises, cool air drops. The air on the south side of the home heats up, rises through the air channel and passes through openings in the roof framing, where it then moves to the north side of the building, cools and drops again into the basement. This process of convection—the flow of air—ultimately creates a loop that continues under its own volition. Sykes then sought to improve upon this process by incorporating the home's basement into the exterior envelope, which allowed the basement's cement floor to pre-heat the air in the winter and cool it in the summer. An operable vent at the peak of the roof then allows for venting of the warm summer air. Sykes' initial designs involved only

a slender air space between these walls, on both the north and south sides, but as the designs evolved, the southern air space grew to become what is now a sun-filled and inviting sitting area, upward of twelve feet deep, at the front of the house.

Tim and Cheryl, on that winter day in 2001, were driving north into New Hampshire to visit a recently constructed Enertia Home. Their affection for the home was immediate. The abundant use of wood appealed to them both. Tim liked that the log walls could breathe, which eliminated the need for mechanical ventilation. And, as for the home's efficiency, it couldn't be ignored. "It was the coldest day of the year," Tim recounts, "and the home was extremely comfortable."

It would be another four years before Tim and Cheryl would begin work on their Enertia Home, working on it nights and weekends as Tim continued to construct stick-built houses. So impressed with the system, however, Tim and Cheryl, along with their two sons, decided to become Enertia Home builder/dealers and have since constructed eight Enertia Homes in the northeast. Sund Energy Homes, as a builder/dealer, receives leads for Enertia Building

Systems and is also paid a commission for the kits its sells direct to its own customers.

Most recently, Sund Energy Homes completed a 2,780-square-foot (including the basement) two-bedroom, two-bath Enertia Home in Chesterfield, Massachusetts. The home is the Morningstar model 3236, one of 14 kit homes Enertia Home now offers. The company also offers mix-and-match alterations to their kits, as well as custom designs.

The Morningstar, erected in Cambridge, was a standard design with the addition of a large dog-house dormer on the south of the building, allowing for more southern glazing and an increase in the home's passive solar gain. The project also included a solar hot water and PV array, along with a 224-cubic-foot, sand-filled heat dump insulated with 2-inch foam board and buried beneath the garage. This dump, which reduced the need for excessive water storage in the basement, also added four weeks of heat storage to the solar hot water.

The inclusion of PV, hot water, the heat dump and passive solar design in the Cambridge project is an approach

to energy efficiency that Tim finds analogous with the Enertia Home itself. "No one system will ever do everything," he says. "You have to combine them." So, rather than rely on one technology, one science or one line of thinking, Sykes and Enertia Building Systems draws from a number of sources and brings that all together into a design of a home that, in most instances, can heat and cool itself. And for Tim and Cheryl, as with most other Enertia clients, this is exactly the type of long-term economic security they wanted in their home. **h**



JAMES ASKEW is a former carpenter and construction manager turned journalist. His accomplishments as a builder can be seen, standing strong, throughout Vermont. And his literary work appears regularly in a

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