SUNSHINE ON MY SHOULDERS

Using sun and wind keeps a 5,000-square-foot household running smoothly.

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It was too good to be true. Anxious to make the move from town to country, Mike and Tina Hubicki found 65 unspoiled acres not far from home in Cobourg, Ontario. Perched on the edge of the Oak Ridges Moraine, the varied landscape couldn't fail to impress. Dominated by a long, teardrop-shaped drumlin, it offered a panoramic view through a stand of hardwoods, while below the hill, a creek babbled its way through a cedar woodlot. Left untouched for years, the acreage would make a dandy site for a country hideaway, except for one hurdle—and it was a big one. "The property was virtually landlocked," Mike reports. With only one tiny corner adjoining an unimproved right of way, access posed a real problem. But even worse, the nearest hydro pole was 700 metres away. "We did a little investigation and found that it would cost us no less than $20,000 for the privilege of hooking up to the hydro grid."

It was hard to believe that such a remote site existed only 10 minutes from Highway 401, the most-travelled express route in all of Canada. But there it was. If they were going to purchase the property, the Hubickis would have to upgrade the road and live off-grid.

For anyone else, this could easily have been a deal-breaker, but not for Tina and Mike. "Already," explains Tina, "we were keen on incorporating any number of green concepts—energy efficiency, state-of-the-art insulation and recyclable building materials—into our housebuilding plans. The more we thought about it, living off-grid was just the next logical step." So without further ado, the land was theirs.

Before making any hasty decisions, the couple waited the better part of a year as they grew well acquainted with their new acquisition. A landscape architect trained in the art and science of site design, Mike analyzed every inch of the acreage, keeping copious notes that would eventually fill an entire binder. "The top priority was

Tina (shown above with daughter, Hannah) and Mike Hubicki built a stylish home in the Northumberland Hills that sets a new standard for off-grid living

How Mike and Tina's Solar Systems Work

FOR GENERATING ELECTRICITY

The basic component in generating electricity is the photovoltaic cell, a small circular "button" that absorbs heat from the sun and converts it to electricity. The Hubickis have xx PV cells on 12 panels, which stand on an open lawn, facing south. The unit operates on a "solar tracker," which follows the path of the sun from dawn till dusk. It can be manually adjusted to adjust for seasonal changes in the angle of the sun.

Direct current from each panel is stored in a bank of 24 batteries in the garage. The batteries also store energy manufactured by the wind generator.

To make the "wild" current usable, it is converted to standard household current through an inverter. Because their large home uses more power than some, it requires not one, but two inverters.

The inverters are connected to an ordinary household circuit breaker box and distributed to each room and appliance via conventional wiring.

Should the system fail, a back-up generator, powered by propane, stands at the ready.

FOR HOT WATER APPLICATIONS

The basic component in generating energy to heat a hot-water system is the gas-filled vacuum solar tube. The Hubickis have 60 of them, anchored to two panels on the roof of their garage.

Sunlight heats the gas in the tube. The gas expands and travels upward to a heat exchanger at the top of each tube.

The heat exchangers heat glycol. Through a highway of piping, heated glycol at 160°F (71°C) flows into coils mounted in the 620-gallon water reservoir in the basement. The coils heat the water in the tank.

Hot water is distributed to sinks, showers and laundry via conventional pipes, but the lion's share of it goes to maintaining the temperature in the in-floor radiant heating system.

During winter months, the solar tubes don't produce enough energy, so the system is augmented with a wood-fired boiler, which can be adapted to propane in case no one is around to stoke the fire.

For more information, a good place to start is the Canadian Solar Industries Association; website: www.cansia.ca

Top: The Hubickis' solar panels follow the path of sun.

A second solar system employs solar tubes mounted to the roof of the garage. Wind generator stands nearby.

to find just the right place to site a new house," he recalls. Eventually, he and Tina settled on a spot near the crest of the drumlin, which offered the best views. There, the hill assumes a long, humpback shape, which naturally enough, inspired Mike to contemplate a long, linear arrangement of rooms in his house design. It's just one of the concepts that made it from the drawing board to the light of day.

Even at that early stage, ideas for an off-grid installation, consisting of a wind generator and solar collectors, were never far from mind. "In this part of Ontario, it is rare that anyone would rely solely on one or the other," Mike explains. "Solar is by far the most efficient, but wind is necessary to get through the winter." As he paced the property, he made notes on

From the start, kitchen, dining room and living area were the heart of the Hubickis' house design.

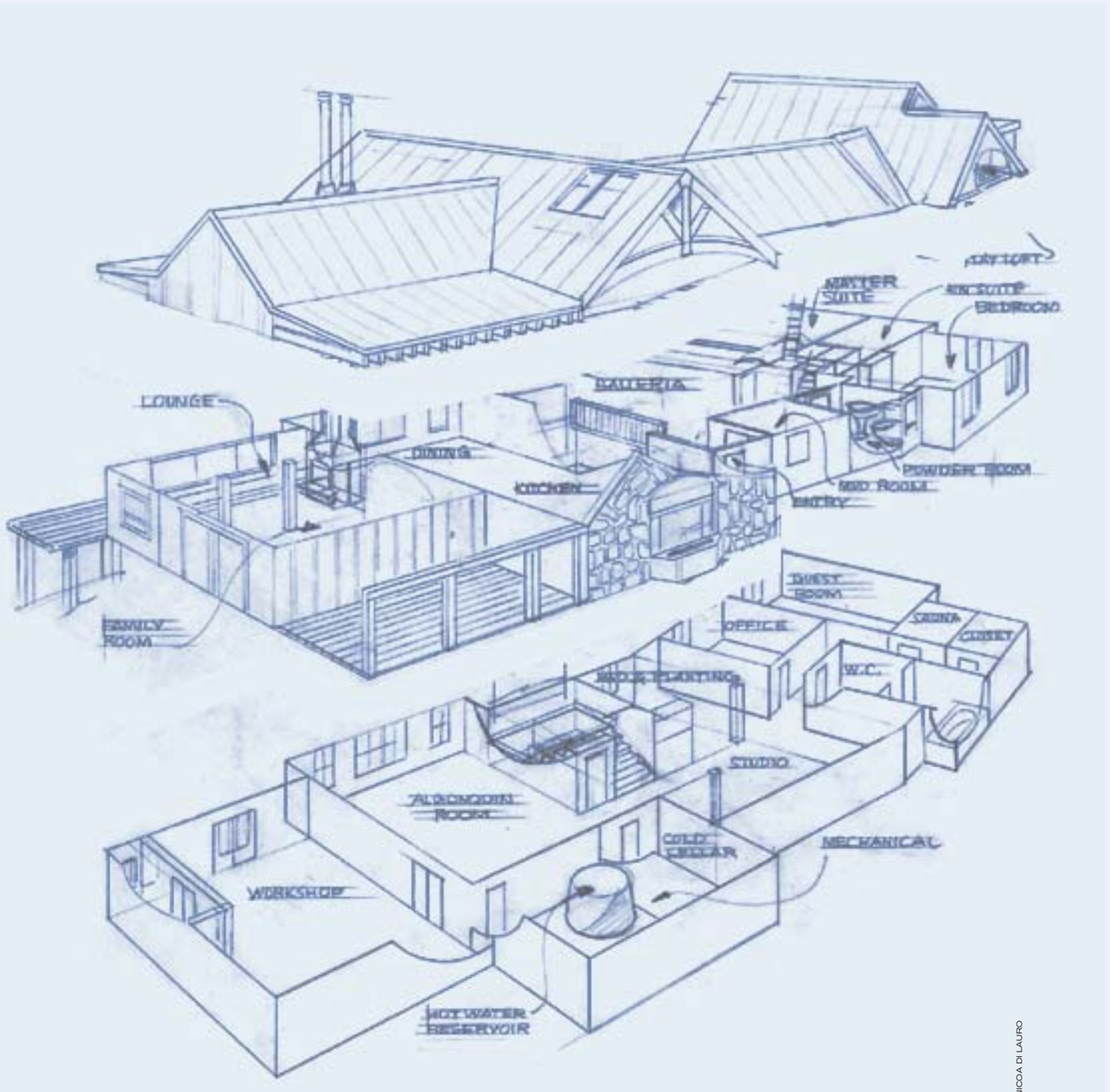
likely sites for a wind tower, which according to his research, would perform best if it were situated on a hilltop and stand at least 30 feet above the nearest trees. Likewise, he scouted a place for a solar installation, keeping in mind that solar panels require not only a southern exposure, but like a vegetable garden, need full sun all day.

From the beginning, the Hubickis' home was conceived as a modern living, At almost 5,000 square feet, complete with all the amenities of a modern living, it is hardly the homesteader's cabin so often associated with off-grid living. Complete with dream kitchen, radiant-floor heating and other contemporary luxuries, there is hardly a clue that this is anything but a conventional home. "We weren't prepared to sacrifice creature comforts," Mike ad-

Below: Mike stokes the boiler with wood (below left), while in another room, a 620-gallon reservoir provides ample hot water for the radiant-floor heating system.

Specs

Concept Two-storey dwelling with walk-out basement. Owner-designed and self-contracted.
Genesis Land purchased 2000; house occupied 2003.
Location Beside the Oak Ridges Moraine in Northumberland County, near Cobourg, Ontario.
Bedrooms 4
Bathrooms 3
Total usable floor area About 4,800 square feet, including basement.
Construction Foundation built of "insulated concrete forms," better explained as styrofoam blocks which fit together like Lego and are then filled with poured concrete. This saves the inconvenience of temporary forms and, because the blocks are left in place permanently, the house benefits from the insulating capabilities of the styrofoam. Walls are conventional 2 x 6 wood frame wrapped in polyiso board for windproofing.



NICOA DI LAURO

Cladding Most of the house is clad with conventional board-and-batten siding; stone veneer façade made with cultured stone.
Roof Metal, considered the environmental choice because it lasts indefinitely and is made of recyclable materials.
Appliances All major appliances are present, but only the refrigerator and washing machine are standard electrical units. Clothes dryer, oven and stove are propane-powered. Space-saving, energy-saving models were specified throughout. A multi-fuel (wood and propane) boiler heats water.
Heat Radiant-floor heating, which works through a series of winding pipes set directly into the floors and connected to a large hot-water storage tank. Heat radiates through liquid in the pipes, through the floor itself and into the room. Supplemental ambient heat from a propane fireplace shared between living and dining rooms.
Insulation Sloping ceilings: Icynene foam insulation to R40; Flat-surface ceilings: blown cellulose to R40; Walls: Roxul batts to R26 (similar to fibreglass but gets the environmental nod for being made from waste slag.)
Electrical service 66 amp service with back-up propane-powered generator. House is completely off-grid, powered by a combination of solar panels, solar tubes and wind turbine (see text). Installation by Energy Depot, Toronto, Ontario.
Lighting Compact fluorescent bulbs (with conventional threaded ends) are used throughout the house.
Windows Large picture windows on north and west elevations are triple-glazed, low-E, argon-filled units; smaller windows are double-glazed.
Floors Pre-finished engineered hardwood and slate tiles in living areas and bedrooms; ceramic tiles in basement.
Landscaping Maintenance and enhancement of existing vegetation. Introduction of tall-grass prairie habitat around solar and wind components to inhibit encroachment by trees. Rehabilitation of natural creekside ecosystems with assistance from the Ontario Wetland Habitat Fund.

Judging by the amenities in the dream kitchen, there is no clue that this is an off-grid house.

A bank of batteries stores energy, while two inverters are required to convert wild current to household electricity.

vises, "So on a scale this big, it's imperative that an alternate energy scheme be planned to the letter, so that the system can deliver." While the house was still on paper, he prepared a detailed spreadsheet that itemized precisely how much energy every appliance and every room would require. Based on his calculations, he surmised his household would consume about 14 kilowatt-hours of electricity each day. "That's not much, especially considering the size of the house," Mike continues. "We have friends in town who heat with electricity. They use up to 200 kilowatt-hours per day."

With his figures in mind, Mike and Tina sat down with Adam Webb, a consultant from Energy Depot in Toronto, to configure the best combination of wind and solar power. For day-to-day electricity, they settled on an array of 12 freestanding solar panels, set facing south and equipped with a "solar tracker" so that they can follow the daily movement of the sun. On clear, blue-sky days, they are more than up to the task of supplying the house with electricity. Picking up the slack on windy days is a wind generator, set high on a 60-foot tower. Both are connected to a bank of two dozen deep-cell

How Mike and Tina's Wind System Works

The basic component in a wind generator is a wind turbine, which looks like a propeller attached to a weathervane. The breeze spins the blades, which in turn spin a generator, which rotates five times for every sweep of the blades.

A magnetic field passes over the wire coils in the generator, which produces electricity.

Direct current from the wind generator is stored in a bank of 24 batteries in the garage. The batteries also store energy manufactured by the solar panels.

To make the "wild" current usable, it is converted to standard household current through an inverter. Because their large home uses more power than some, it requires not one, but two inverters.

The inverters are connected to an ordinary household circuit breaker box and distributed to each room and appliance via conventional wiring. Should the system fail, a back-up generator, powered by propane, stands at the ready

For more information, a good place to start is the Canadian Wind Industries Association website: www.canwia.ca

batteries, capable of storing plenty of energy; in turn, the batteries are connected to an inverter, which converts the direct, "wild" current into usable household electricity.

So far, the Hubickis' installation is not unlike most other off-grid configurations, although it is considerably larger than what would be necessary for a humble shack in the woods. Still, it wasn't large enough. That's because the couple planned to warm their house with in-floor radiant heat, which demands vast quantities of hot water, far beyond that required for laundry and ordinary household use. The heating system—the darling of today's builders—operates with a complicated network of tubes embedded in the floors. Hot water circulates through the tubes, warming the floor itself, which in turns radiates heat throughout each room. "It's a surprisingly efficient idea," explains Mike, "but even so, it accounts for about 90 percent of our hot-water demand, which, if it were heated with an electric hot water heater, would be beyond the capabilities of the solar and wind generators." So he and Tina employed a *second* solar system—this one composed of solar thermal tubes, whose sole function is to provide energy to heat hot water. "Unlike our solar collectors, the tubes aren't connected to the batteries, but go straight to a 620-gallon tank in the basement, which acts as a hot-water reservoir for all household needs, including the in-floor heating. However, it falls short during the winter, so a back-up system—a wood-and propane-fired boiler—stands by to see the winter through.

In the end, the wind and solar accessories cost upwards of $50,000, more than twice the price of hooking up to the grid. "It sounds like a lot," admits Tina, "but because we will never ever face another hydro bill, our system will pay for itself sooner or later." Perhaps sooner than later, considering that the current price Ontarians pay for electricity is artificially low. If and when prices rise to true market levels, perhaps more families will be following Mike and Tina's example. ✲

Combining his career talents as a landscape architect and site planner with the lessons he's learned in living off-grid, Mike Hubicki offers his services to homeowners interested in sustainable design and renewable energy. Learn more on his website: www.H2omes@net

Under Construction **A.Construction commences with excavation and placement of footings. B. Insulated concrete forms are the basic "building block" in the construction of the foundation. C, D, E. The walls rise; the house takes shape. F. The basic component of in-floor radiant heating is a network of tubes, shown here just prior to being smothered in poured concrete. They are connected to the hot water reservoir.**