

## The House that Holmes Built Canadian Home Workshop, September 2008

Five years ago, homeowners Joe and Christina Kovalik hired a family friend to fix up their small bungalow in Toronto. Very quickly the \$200,000 job went off the rails—shoddy work; unexpected costs—so they put a stop to the job. In retaliation, the renovator put a \$535,000 lien on the house. This was 2005, a time of piling debts and a crumbling house. Uncertain what to do next, Christina wrote a tearful seven-page letter to reno-guru Mike Holmes, explaining their predicament, hoping the *Holmes on Homes* crew could fix things up.

Their wish came true, except instead of a fixing up the Kovalik bungalow, Holmes tore down the house—the damage to the foundation and other spots was too immense for a regular reno, said Holmes—and replaced it with a state-of-the-art example of green homebuilding with green roofs, grey-water and rainwater collection systems, spray-foam insulation, in-floor radiant heating and solar panels. Why go to all this trouble? “This house is a prototype for the houses I believe we should all be building,” said Holmes, who’s mantra, “If you’re going to do something, do it right the first time” was never more apt.

Sustainable, system-led design “takes into account everything from air quality, resource efficiency and the type of building materials used, plus what’s called ‘universal design’: creating a house that’s accessible, with wide doorways, curb-less entranceways, levered door handles—a house that can accommodate all types of people through all life stages,” says Mark Salerno, Canadian Mortgage and Housing Corporation’s (CMHC) Toronto district manager.

From a distance, the house looks like a giant box opened at the front (and I mean this in a good way). From the front, large concrete slabs mix well with myriad windows and wooden cladding to create a feeling of strength and warmth. This super-green house is also a home; people live here.

While the Holmes house stands out as a clear example of super-green building—steel and green roof; fireproof concrete forms that resist rot and mould; extreme water and energy conservation—it’s not the only green building on the block. Canadians are increasingly asking for and expecting this type of building, according to a 2008 J.D. Power & Associates survey conducted for the EnerQuality Corporation, which oversees the Energy Star program for new houses.

According to the survey of more than 2,000 recent homebuyers in either the GTA or Ottawa, 98 per cent expect builders to offer energy efficient features, which is why some homebuilders, including Mattamy Homes and Reid’s Heritage Homes are making Energy Star homes, which are 30 per cent more energy efficient than regular homes, the new standard. (See “In the Future” sidebar)

Low-tech, large payoff

“This room is great any time of day,” says Joe, leading me into a living room fit for a Roman emperor. Massive laminated-cedar beams climb up the three-storey, 24-foot-high ceiling flanked by remote-controlled windows. The high ceiling and windows encourage convective airflow; hot air is expelled through the windows, naturally cooling the house. “It means we only need to air conditioner on really hot days, if at all,” says Christina.

Natural cooling and heating continues with large, south-facing windows providing passive solar gain warmth during winter months, and because the windows are recessed, they’re hidden from the higher-flying summer sun that can create oven-like conditions.

This low-tech, highly efficient design permeates throughout the house: the walls are painted with zero-VOC paint; non-allergic carpets line the stairs; easy-to-clean tiles and hardwood flooring eliminate mould and dust buildup, which, combined with the house’s high-tech filter system and ultraviolet furnace filters, provides superior interior air quality.

“[Consumers] are starting to get the message that indoor air quality affects health,” says Thomas Green, project manager for CMHC’s EQUilibrium “healthy housing” initiative (see “In the Future sidebar). Off-gassing from engineered wood products and paints and other finishes laden with VOCs—to say nothing of mould, dust and dander in carpet—can combine to create an indoor air index three to four times more polluted than outside air, according to CMHC, which is likely the reason 20 per cent of Canadians have some form of lung disorder. In other words, green homes aren’t just about creating healthy physical structures but also healthy homeowners.

Hardly low-tech, the home houses an elevator (installed for health reasons related to Joe’s back). “You can see how well insulated this house is,” says Christina, pointed to the exposed concrete forms stuffed with spray-foam insulation, visible through the see-through elevator door. The entire house is made with huge slabs of pre-poured concrete, a building material that requires little maintenance, resists mould, rot and fire and is made from easy-to-replenish ingredients making it an affordable, efficient building material. What’s more, concrete provides what’s known as “thermal mass,” which means it releases heat taken from daytime sun and releases it during night or in cooler conditions, again reducing heating and cooling costs. “The furnace hardly ever fires up,” she adds, thanks also to the radiant in-floor heating throughout the entire house, including the basement and garage.

“You can walk around barefoot and in a T-shirt in winter,” adds Joe. “There are no hot or cold areas, everything’s just...nice.”

### Going high-tech

“They call this the utility deck, but it’s more like a secret oasis,” says Christina. Indeed, the home by Holmes is filled with high-tech devices with hefty upfront costs but long-term energy and maintenance savings. The ping pong table-sized photovoltaic panels —“operation is idiot-proof,” says Joe—help preheat the domestic water supply, while the

second set of four panels produces battery storage power fed into a 10,000-watt back-up system in the event of a power failure. “We can also sell back to the grid any power we generate but don’t need,” says Christina.

Since they’ve only been living in the house for a few months, they can’t give a cost-savings breakdown; however, a typical-sized, two-kilowatt grid-tie solar system, which costs about \$29,000 installed, would save about \$1,814 annually and pay for itself in 16 years; the 10,000-watt model here is priced closer to (gulp) \$85,000.

Still on the roof, on another “secret deck,” accessed through a top-floor door, is the green roof. Since it was first installed in winter, the Holmes crew had to come back to replant, “but now it’s good for life,” says Christina, who plans to add herbs and annuals alongside the varieties of sedum, tough little plants hardy enough to withstand heat and cold without requiring irrigation. They typically grow a foot high.

“We’ll have to water the roof during really hot periods,” says Joe. While there are different kinds of green roofs, this one is a modular system made up of trays of plants grown offsite before installation. Other systems include “intensive” roofs where the greenery takes up the entire roof; and “blanket” roofs, the lightest option with plants growing in thin organic tiles rolled onto the roof. While they seem novel here, more than 10 per cent of flat-roofed houses in Germany have green roofs.

Green roofs improve outdoor air quality while heat from escaping during winter as well as creating a sun-absorbing blanket during summer, a time when black, shingled roofs become hotter than Hades. They also absorb rainwater and snowmelt, thereby reducing the amount of water drained into municipal drain systems—all with little maintenance (the odd watering here, the odd weed clip there).

It’s easiest to add a green roof to a new house or major addition, says Holmes, but retrofits are possible, too. Flat or sloped, the big factor is weight and waterproofing. Have a structural engineer check how much weight your roof can support, and then make sure it’s 100-per-cent waterproof. Costs range depending on the type and size of green-roof system, but expect to pay between \$12 and \$20 per square foot.

### Watery Ways

“These remind me of the urinals at the old Maple Leaf Gardens,” says Joe, pointing to the rainwater collection troughs along the side of the house. The troughs are part of a system that runs along the house’s exterior, collecting rainwater that flows into a concrete cistern and treatment tank buried beneath the front lawn.

According to Environment Canada, toilets use one-third of a household’s total water consumption; add to this laundry, also fuelled by grey-water, and you’re looking at a huge slash in water usage. “We were worried we’d run out, but with the amount of rain we get over the year, it’s more than enough,” says Joe.

Not all provinces allow grey-water systems (Quebec, for example), or if they do, there are different technical requirements; however, most areas allow at least rainwater collection, which can save about 150 litres of drinking water per day, per household, according to Environment Canada.

“It took a little to get used to the colour,” says Christina, pointing at the greyish water in the toilet. “It looks like you haven’t quite flushed.” While it might not look pristine (think septic tank water), this grey-water system is perfectly suitable for watering lawns, powering washing machines and flushing toilets. Just don’t drink it.

Like everything else high-tech, prices range with grey-water systems depending on size and complexity, but expect to pay about \$1,500 plus installation, with yearly savings of about 35 per cent.

### Surreal Surroundings

“It still feels so unreal,” reveals Christina as we sit around the quartz-topped kitchen counters. “Like we’ve won some sort of lottery.” After spending almost two years living away from the house, the reveal was pretty sweet, even if it happened between midnight and 4 a.m. on cold winter morning. “Let’s just say there was lots of champagne.”

Lengthy construction can take its toll on any friendship, let alone neighbours, but the Kovalik’s say they’ve received many cards and gifts as a welcome back to a neighbourhood they’ve been in for more than 10 years. Of course, now their home is the model citizen, driving neighbours to increase their own efficiencies (one house, three doors west, is powered by Bullfrog Power, a renewable energy company).

As a reminder of this dream come true, the house sports a metal insignia from Holmes, his stamp of approval. “Driving up the road is still surreal,” says Joe. “This is where we live?”

### Sidebar:

#### In the Future

What’s the best way to show the benefits of green technology? “Build actual houses,” says Thomas Green, CMHC’s EQUilibrium Competition, a cross-country contest to design and build, or in some cases, retrofit, net zero houses: homes that use as much energy as they create. “These are real homes for real people, not some sort of R&D or design project.”

The competition began with a call for entries with criteria set to CMHC’s five, core “healthy housing” principles: health, energy, resource conservation, environment and affordability. The initial call garnered 72 responses, “way more than we expected,” says Green. “It showed us things are really changing in the [homebuilding] industry, especially considering our tough requirements.”

How demanding was it? “We’re talking about homes that use 80 per cent less energy than regular homes,” says Green. But the challenge went far beyond energy use.

“Our house uses 30 per cent of the water compared to a regular house,” says Sevag Pogharian, a Montreal-based designer who’s EQilibrium entry, Alstonvale Net Zero House, was one of 12 winners. “We’re also going for net-zero transportation.” Adding an extra few photovoltaic solar panels onto the house (1.5 kilowatts) “creates enough energy to power an electric vehicle 25 kilometres daily.” What’s more: the house design incorporates basic food production. “We’re not saying the homeowner has to be a farmer, but the site does allow for basic food production—vegetables, that sort of thing.”

Canada pioneered a lot of these technologies in the 1970s and 1980s, says Luigi Ferrara, author of *Canada Innovates: Sustainable Building* (Key Porter Books, 2008). The problem is, while Canada was a pioneer, other countries took one step further and actually started building more innovative houses long ago, especially places like Austria, which has a similar climate to Canada. In that country, as well as The Netherlands, “normal people are living in homes designed to work with nature.”

Pogharian is building the single-family detached house in Hudson, Que., about 45 minutes from Montreal, a high-end neighbourhood not used to vanguard design. Pogharian says the other big obstacle was a threatening residents association. “It was a not-in-my-backyard mentality,” he says. “While they commended me for the effort, they didn’t want anything ‘weird’ in their neighbourhood.” Luckily, Pogharian was eventually able to win over the locals, but this mentality “doesn’t bode well for the future,” he adds.

Other winners include the Minto Manotick House in Ottawa, which features an “all-off switch” that not only turns off all lights but also computers, cable boxes, amplifiers, and so on when the homeowner leaves the house; Calgary’s Echo Heaven project, the building of 25 houses featuring all things green plus a community greenhouse and a separate building for guest accommodation and work-at-home offices.

All EQilibrium winners will be open for public viewing for six months after they’re built (check the CMHC website for viewing dates).

### Sidebar: Top Green Upgrades

#### A cost/benefit chart of top green upgrades

Seventeen per cent of greenhouse gas emissions are generated from energy consumed in the home, according to the Office of Energy Efficiency. Compared to standard homes built to minimum building code requirements, Energy Star-qualified homes reduce energy use by about 30 per cent every month. More than 50,000 homes in Ontario alone are built to ES standards, including every single-detached home built by Reid’s Heritage Homes, based in Cambridge, Ont.

“Consumers have stopped basing upgrade decisions on payback,” says Laura Martin, senior market research analyst, product development at Reid’s, which was named 2007 Green Builder of the Year by the Ontario Home Builders Association, and won three trophies at this year’s EnerQuality Awards. “Green is everywhere, so now they’re seeking out these products and upgrades.”

Still, it helps to get a sense of cost/benefit when it comes to green upgrades. From basic to elaborate, here are 10 smart upgrades.

1. Upgrade: Low-E Argon Windows  
Extra Cost: 10%  
Benefits: reduces heat loss/gain by 20%; reduces condensation and prevents mildew  
Payback: less than one year
2. Upgrade: R-50 attic insulation (code calls for R-40)  
Extra cost: \$400 (for 1,200 sq.ft.)  
Benefits: 33% more energy efficient  
Payback: less than one year
3. Upgrade: 2” foam insulation under basement slab  
Extra Cost: \$2,200 (for 1,200 sq.ft.)  
Benefits: reduce heat loss by 25%  
Payback: four years
4. Upgrade: Drain water heat recovery system  
Extra Cost: \$1,000 (can also rent)  
Benefits: recovers 80% of hot water energy; thermal energy is recycled to save 40% on heating costs  
Payback: 4.5 years
5. Upgrade: Real-time electricity monitor  
Extra Cost: \$200  
Benefits: helps reduce electricity usage by up to 20% by tracking energy use per kilowatt hour; also tracks greenhouse gas emissions  
Payback: less than one year
6. Upgrade: Programmable thermostat  
Extra Cost: \$60

Benefits: reduce heating and cooling costs by up to 40%; reduces air pollution

Payback: less than one year

7. Upgrade: Bamboo flooring

Extra cost: same as midline hardwood (about \$6 sq.ft.)

Benefits: 27% harder than red oak and 7% harder than maple for more durability; bamboo is sustainable, regenerating itself in four years compared with 50-year hardwood cycle

Payback: immediate

8. Upgrade: Tankless hot water heater

Extra Cost: \$500 to \$1,500 depending on size (can also rent)

Benefits: Reduce electricity usage by 15% by heating water on demand rather than continuously heating water in a large tank

Payback: 4 to 7 years

9. Upgrade: Dual-flush toilet

Extra cost: \$100

Benefits: Reduce water usage by 26% by choosing amount of water needed per flush

Payback: less than one year

10. Upgrade: Hydronic radiant in-floor heating

Extra Cost: \$700 per 100 sq.ft.

Benefits: provides even heat and eliminates drafts; keeps warm air at floor, not lost in ceiling, which means temperature can be set lower than forced-air systems for energy reduction; long lifespan (more than 50 years); quiet

Payback: 10 years