Daikin Altherma – A Great FIT

A unique energy program combined with an innovative heat pump system and other green initiatives, help one man achieve his net-zero home dream.

The Challenge

To build "a better green home"

Daikin's Solution

Daikin Altherma - a single system that delivers a cost effective, comfortable space heating, domestic hot water, and space cooling that helped reach a Platinum LEED certification

Application:
Residential

Location:
Toronto, Canada

Victor Kam is an information technology professional who "has always had a green devotion." Always on the cutting edge of technology, Kam is the type of person who enjoys the challenge of "building a better mouse trap."

And while he had considered building "a better green home" for years, it wasn't until the Ontario Power Authority provided a significant financial incentive that he actually embarked upon the mission. Moreover, his discovery of a single system that delivers cost effective, comfortable heating; domestic hot water; and space cooling; steered the project toward the net-zero goal.

The Financial Motivation

In April 2009, following the announcement of the Ontario Power Authority's feed-in tariff (FIT) Program, Kam set about building an extremely energy efficient home in northern Toronto. He initially envisioned the project as an environmentally responsible build, but it quickly evolved to the point where LEED Gold certification became a minimum goal, with LEED Platinum within reach. "Ultimately we are trying to achieve net-zero, which would make it the largest net-zero house in the country that we are aware of," Kam said.

The 4,350-square-foot (plus 2,000 square feet in the basement) home, which also includes a four-car garage and a 12x26 foot storage area above the garage, was situated for maximum solar gain and incorporates south facing windows.

He sought to prove that it is possible to construct a 4,350-square-foot (plus 2,000 square feet in the basement), net-zero home with energy efficient materials and a reasonable payback timeframe. “The motivation came from looking at the building industry, and how slowly technology has progressed in it, and how different ideas can be incorporated into a single project,” Kam said.

His goal was to be cash flow neutral or positive in each phase of the home’s infrastructure over the typical 25-year Canadian mortgage. “But there were some choices that were made where payback might be somewhat longer, and I could justify that if the energy and environmental benefits were large enough.”

The Ontario FIT Program, North America's first comprehensive guaranteed pricing structure for renewable electricity production, offers stable prices under long-term contracts for energy generated from renewable sources, including: biomass; biogas; landfill gas; on-shore and off-shore wind; solar photovoltaic (PV); and waterpower. It was enabled by the Green Energy and Green Economy Act, 2009 which passed into law in May 2009.

“Until that point it was hard to justify the cost of all the different technologies, especially the solar panels,” Kam said. “But, basically, via the feed-in program, I can end up getting in excess of a $25,000 (CDN) rebate annually.”

“Virtual Friend” Offers Great Advice

Kam, who also works part-time in real estate, began an intensive research process, learning as much as he could about new building technologies. “I started talking to a lot of people about energy efficient homes, and Google™ and I became good friends.”

While homeowners typically defer HVAC equipment specification to building experts, Kam was comfortable making major decisions. The project’s architect handled the home design and aesthetics, but Kam specified the equipment.

He originally planned to use a geothermal heating system or a natural gas furnace, but those methods presented roadblocks. “With natural gas, we would not have had a chance to get to net-zero; with geothermal, our payback calculations were toward 40-50 years based on the current natural gas rates.”

Kam realized a net-zero home was within reach after consulting with Comfort Connections, a Markham, Ontario-based specialty HVAC distributor. Comfort Connections President Tom Loughran and Vice President and

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The Daikin Altherma system also supplies the home’s domestic hot water, and there are plans to integrate solar water panels at a later date. In fact, Kam left two open spaces on the roof for a solar kit for Daikin Altherma.

Sales Manager, Tom Keough, introduced Kam to the Daikin Altherma system. This innovative air-to-water heat pump system uses inverter compressor technology to precisely match heating output to the required capacity, providing a significant environmental and energy efficiency impact.

Daikin Altherma feeds the basement in-floor radiant heating and a Lifebreath Clean Air Furnace with a built-in HRV (which uses a water coil for the first and second floors). The system also supplies the home's domestic hot water.

A total heating system, Daikin Altherma delivers cost effective, comfortable heating; domestic hot water; and space cooling; while achieving seasonal efficiency comparable to ground-source heat pumps. "Technically net-zero was not my target in the spring of 2009, but after being introduced to the efficiency of the Daikin Altherma it became my target," Kam said.

Kam added that "compared to a traditional natural gas forced air system (without radiant) Daikin Altherma might have cost about $10,000 more. However, with the in-floor radiant included in the equation, that number drops to about $6,000. A geothermal system would have cost another $10,000-$15,000 on top of the installed Daikin Altherma system." However, it's essential to consider that the Daikin Altherma system also provides domestic hot water and air conditioning.

Kam added that Daikin Altherma would help balance and justify the additional costs over the natural gas furnace and gain the benefits of the energy efficiencies, while still having a reasonable payback. He specified Daikin Altherma and his home ended up being the first installation in Ontario.

Balancing Cost and Energy Efficiency

The entire project was driven by cost recovery. "The whole

Other Keys to Net-zero

Construction began in November 2009 with a host of key elements deployed to help achieve net-zero status. The home, which also includes a four-car garage and a 12x26-foot storage area above the garage, was situated for maximum solar gain and incorporates south facing windows. That makes sense since the home has a 30kW solar panel system expected to generate 54kWh to 60kWh annually. Even the soffit overhang depths were designed to block the sun in the summer but allow it to warm the house in the winter.

Insulating concrete form walls; structured insulated panels; EPS ceiling insulation; were used in key spots and the bathrooms were plumbed to exhaust through the HRV portion of the furnace.

A condensing washer/dryer system prevents air from being exhausted air outside. Additionally the design incorporated triple glazed windows and a 1,585-gallon rain storage system for irrigation, which while not part of net zero, gains the home LEED points.

philosophy was to be as cash flow neutral as possible so anything that had a payback was open game." So while he favored the energy efficient in-floor radiant heating system in the basement, he couldn't justify the added expense of using it on the first and second floors.

Working with the Ontario distributor for Daikin AC, Comfort Connections, and HVAC designer, Richard Melless, Kam designed a system in which Dakin Altherma feeds the basement in-floor radiant heating and a Lifebreath Clean Air Furnace with a built-in HRV (which uses a water coil for the first and second floors). The system also supplies the home's domestic hot water, and Kam plans to integrate solar water panels at a later date . In fact, he left two open spaces on the roof for a solar kit for Daikin Altherma.

Due to Toronto's harsh winter climate, they also installed a tankless hot water system to supplement the Daikin Altherma system. Based on the heat loss calculations, the Daikin Altherma would not be sufficient at temperatures well above the design temp (-4ºF); the homes heat loss per the building permit at design temperature was 80,000 Btu.

"We would use Daikin Altherma to as low an ambient temperature as possible, where its efficiency is more cost effective, then switch to the tankless, with the logic being programmed into the Altherma Hydrobox, with no user intervention required," Kam explained.

Loughran said that while Comfort Connections is involved in a lot of green building work, working on a potential net-zero house was a great experience and the timing for this job was perfect since Daikin Altherma played such a large role in getting to net-zero. "We had just come back from Daikin Altherma training and felt Altherma was very promising and worked with the builder to specify it on this job," he said.

Nick D'Orazio, President of Home Comfort Systems Ltd., who installed the Daikin Altherma system, had never worked with it before. However, he enjoyed learning about the product and the overall experience. "I personally like the idea of the air-to-water heat pump," he said, adding that the system has been running very smoothly to date.

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Expectations Exceeded

Kam, his wife and three children, and his parents plan to move into the home by March 2011. He has been quite pleased with his decision to select Daikin. "We didn't start off as shooting for net-zero but with Altherma we thought we'd be close to it," he said.

And while he was excited about the energy saving aspects of the Daikin Altherma system, Kam was pleasantly surprised by another aspect of the system: "It's literally right outside one of the bedroom windows and it far exceeded my expectations in terms of how quiet it is."

It's as though, just like the Daikin Altherma, this home has exceeded expectations on many levels. Consider that "better mousetrap" built.

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Additional Information

Product Profile
Daikin Equipment

Daikin Altherma

Indoor Section - Hydrobox
(EKHBX054BA6VJU)

Outdoor Section - Condensing Unit
(ERLQ054BAVJU)

Domestic Hot Water Tank
(EKHWS050BA3VJU)

Location

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Toronto, Canada

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About Daikin AC

Daikin AC offers North America intelligent heating and cooling solutions with superior energy performance and sophisticated design. These advanced systems fall under the Daikin Altherma, Quaternity™, VRV®, VRV-S® and SkyAir product names. The company located in Carrollton, Texas, is owned by the Japanese-based Daikin Industries, Ltd. For more information, call 866-4DAIKIN or visit www.daikinac.com.