

## DAIKIN ALTHERMA™ DELIVERS DESIRED FOOTPRINT ... BOTH LITERALLY AND FIGURATIVELY

**The Challenge**  
Oregon locals embarking upon building the most sustainable energy efficient home possible, wanted a heating solution worthy of their green vision.

**Daikin's Solution**  
The first U.S. installation of Daikin Altherma™ - a domestic heating and hot water solution providing outstanding performance even during the coldest months.

**Application:**  
Residential

**Location:**  
Portland,  
Oregon  
USA

Portland, Oregon consistently ranks among America's greenest cities. In fact, a recent *Popular Science* magazine study rated it **the** country's greenest city. So when Dawn Bauman and Wendy Broussard set out in February 2007 to build a home in Portland's Collins View neighborhood, their quest to make it as sustainable, energy efficient, and eco-friendly as possible wasn't out of the ordinary.

However, one eco-friendly aspect of the home would turn out to be unique – so unique in fact, the homeowners have only half-jokingly considered putting a

guest book in their mechanical room. Bauman and Broussard ended up with the first installation of the Daikin Altherma™ system in the U.S. and a tremendously eco-friendly heating and hot water supply solution resulting in multiple tours of the home's mechanical room.

"We are strong believers that living on this planet is a privilege and we need to be good stewards of it. Although we all have footprints we leave behind – we decided ours could be just footprints and not dents left on the environment," Bauman said.



*The Bauman-Broussard home, which received a LEED Platinum rating, is the site of the first installation of Daikin Altherma in North America.*

## MANY DEMANDS, FEW SOLUTIONS

Bauman and Broussard began the project in winter 2007 by interviewing several architectural firms, focusing on ones with green building expertise. They selected Constructive Form Architecture and Design, LLC, a young/start-up firm whose members have “environmentally supportive” design experience throughout the U.S. and Europe.

Brent Hinrichs, architect with Constructive Form, explained the homeowners were intent on selecting as many green options as made sense for them. This involved extensive research and discussions since the design intent was “to use a minimal amount of energy and the most efficient (though not cost prohibitive) systems available, in conjunction with reducing the overall electric and heating loads for the project as a starting point,” Hinrichs said.

“The air-to-water heat pump was the preferred option...otherwise we would have been looking at a solar thermal preheat for a modulating electric boiler system given the goal of eliminating fossil fuel,” he recalled. Hinrichs and his Constructive Form co-owners, Simone Goldfeder, designer, LEED AP and Kina Voelz, architect, LEED AP, discovered none of the North American air-to-water heat pump systems under

development were available at the time. They also learned the other existing systems had lower efficiencies – especially at winter temperatures.

**“The air-to-water heat pump was the preferred option...otherwise we would have been looking at a solar thermal preheat for a modulating electric boiler system given the goal of eliminating fossil fuels.”** *Brent Hinrichs, Architect Constructive Form*

Thus, they contacted every international manufacturer they could find via the Internet, and found Daikin Altherma was an all-electric system with a variable speed “inverter” compressor providing a high coefficient of performance while delivering the sought after combined/integrated hydronic and domestic hot water functionality.

They worked with the local Daikin AC office and when Daikin officials approved the home as an introductory test-site for the continental U.S., Daikin Altherma

was specified. “Daikin was very responsive and engaged in identifying potential test sites for the Daikin Altherma system in North America,” Hinrichs recalled.

## A NORTH AMERICAN FIRST

Daikin has more than 50 years of experience with heat pumps and provides more than a million of them to homes and commercial applications each year, so while Daikin Altherma™ was new to North America,



*The Daikin Altherma system consists of 2 main components (outdoor unit and hydrobox) that can also be combined with optional accessories such as a water tank and solar thermal kit to ensure ideal water temperature.*

everyone involved in the project confirmed that a proven history of

performance and efficiency was the most important aspect of its selection for the job.

Broussard and Bauman were fairly active in the design of the home, and at one point seriously considered using only a wood stove for heating. But they didn't warm to the idea of starting a fire each morning for warmth. "We knew we wanted in-floor radiant heating – but we never really had to pursue other brands of systems, thanks to the guidance from our architect/design firm," Bauman said.

Construction started in May 2008. The HVAC contractor selected for the job, Jacobs Heating & Air Conditioning, is the Portland area's largest Daikin Network Alliance (DNA) partner and had extensive experience with other Daikin products. The radiant heating system, which has four zones and runs throughout the 1.5-story, 1,820 square-foot home, was one of the first aspects of the mechanical system to be installed.

Brian Erdahl, lead technician at Jacobs, explained all of the radiant floor tubing was run to the remote manifolds in the walls and some panel radiators were oversized, so they could match the BTUs needed with 120°F water. Next, the contractor ran supply and return feed lines to the mechanical room to supply the radiant floor and panel heaters in four separate zones.

After the plumber installed the

plumbing lines and everything was roughed in, the Daikin Altherma outdoor unit and the Hydrobox (Daikin's indoor unit containing the refrigerant/water heat exchanger) were set for installation. A heat recovery ventilator was also installed to control the fresh air entering the house and works hand in hand with Daikin Altherma for outstanding efficiency and air quality.

While there were some European-to-U.S. voltage and metric-to-standard conversion challenges, they were all overcome fairly quickly and easily. Additionally, Jacobs had to work with the city of Portland

for approval of the unit since there was an ETL listing, but no applicable AHRI testing and rating program. But, Erdahl said the city officials "were more than happy to let a system this efficient go into a home in the Portland area and they were great to work with."

### EFFICIENCY UNDER CONTROL

Daikin Altherma provides the ability to intricately monitor and manipulate system performance, and features an automatic control system adjusting the system's operation to varying ambient conditions. It can basically be tuned to suit the homeowner's exacting requirements, and also

## FLEXIBILITY IS EVERYTHING

*Daikin Altherma is flexible enough to be applied in many types installations - new or retrofit. Daikin Altherma can be connected to:*

- **standard low temperature radiators**
- **under-floor heating**
- **fan coil units**



*Standard low temperature radiators deliver comfortable heating in the Bauman-Broussard home.*





*Bauman and Broussard ended up with the first installation of the Daikin Altherma™ system in the U.S. - a tremendously eco-friendly heating and hot water supply solution.*

features an automatic re-start feature in the event of a power interruption. Additionally Daikin Altherma system can be equipped with a back-up heater (in a refurbishment type application, Daikin Altherma can reuse an existing boiler installation) that can be used for supplemental heating during extremely cold outdoor temperatures or as a backup to the outdoor unit.

The home's control system was set up so the thermostat calls for heat, opens the valve, and turns the circulation pump on, but the pump will only run when necessary. Thus, the

homeowners are not paying for the pump to check water temperatures when they are in the nonheating season.

Another benefit offered by Daikin Altherma is that it operates extremely quietly – as low as 49 dB(A) – and can even be set to produce 10dB(A) less noise during the night. In addition to Daikin Altherma, and a host of other eco-friendly initiatives – such as

installation of a 2.4 kW solar photovoltaic system – enhanced energy savings considerably. The homeowners are actually selling power back to the grid, and providing all of their domestic hot water with the use of Daikin Altherma via the solar photovoltaic panel array.

The house was also pre-plumbed for future solar thermal inputs and there is a potential for using a reverse-cycle to provide chilled water for partial tempering of the floor during cooling season.

Efforts like this earned the home – which was completed in February 2009 – Platinum certification under the United States Green Building Council's LEED for Homes Pilot Program. And while that certification certainly hinged on several components, Daikin Altherma

played an instrumental role.

Bauman and Broussard have been surprised at the number of people who have asked them where they can get the Daikin Altherma system in the U.S. However, they say the best surprise is the efficiency. “Our electric bill is amazingly low for the size of the house and the fact that the entire house runs on electricity alone.”

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*Dawn Bauman  
Wendy Broussard ,  
Owners*

# DAIKIN ALTHERMA

All-in-one, all year round heating, cooling and domestic hot water supply solution

Daikin Altherma™ is an innovative system that **heats**, produces **domestic hot water** and can even **cool** spaces. Daikin Altherma delivers maximum comfort the whole year through.

These heat pumps are an alternative to conventional gas or fuel oil heating.

- **Daikin Altherma use renewable energy sources (such as outside air)**
- **Daikin Altherma delivers considerable savings in energy**
- **Daikin Altherma delivers a significant contribution in the fight against CO<sub>2</sub> emissions**
- **Daikin Altherma can provide heating, cooling and domestic hot water**

## ENERGY EFFICIENT OPERATION

The air-to-water heat pump from Daikin uses a sustainable energy source. In fact, it extracts heat from the outside air.

The system consists of a closed circuit containing R-410A refrigerant. A thermodynamic cycle is created through evaporation, condensation, compression and expansion. A heat pump “pumps” heat from a low to a high temperature level.

The heat raised is transferred to

the water distribution system (under floor heating, low temperature radiators and/or fan coil units) in the home via a heat exchanger.

Depending on the model and the conditions, the Daikin Altherma air-to-water heat pump delivers between 3 and 5 kWh of usable heat for every 1 kWh of electricity it uses.

Daikin Altherma can be configured for use in both new and refurbishment applications, and connects to standard low temperature radiators, under floor heating or fan coil units. In combination with a solar thermal set-up, Daikin Altherma uses thermal energy from the sun to

raise the temperature of domestic hot water, cutting on both CO<sub>2</sub> emissions and operating costs.

**Daikin Altherma is flexible enough to be configured in several ways:**

- **Space Heating Only**
- **Space Heating and Domestic Hot Water Production**
- **Space Heating and Domestic Hot Water Production with Solar Space Heating**
- **Space Cooling, Space Heating, Space Cooling and Domestic Hot Water Production**



## Contact Information

### Manufacturer

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Carrollton, TX 75006  
972-245-1510  
www.daikinac.com

### Architect/Building Design

Constructive Form Architecture & Design  
Brent Hinrichs  
2975 SW Upper Drive  
Portland, OR 97201  
503-297-5890  
info@constructiveform.com

### HVAC Contractor

Jacobs Heating & Air Conditioning  
4474 SE. Milwaukie Ave.  
Portland, OR 97202  
www.jacobsheating.com

### Builder

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13851 SW Alpine View Ct  
Tigard, OR 97224  
503-572-4250

## Additional Information

### Daikin Equipment Bauman Broussard Home

#### Daikin Altherma

Indoor Section - Hydrobox  
(EKHBX016AB6V3)

Outdoor Section - Condensing Unit  
(ERHQ011A)

Domestic Hot Water Tank  
(EKHWS200B3Z2) (52.8 gallons)

#### Featured Eco-friendly Aspects included:

Low-VOC paint and formaldehyde-free glues  
Recycled paper and resin countertops  
Compact fluorescent lights  
Solar-powered landscape lighting  
Pervious concrete driveway  
100% of storm water treated on-site  
Reflective metal roof  
Rainwater collection for site irrigation  
Flow-through planters  
Site restoration  
Native landscaping  
Highly efficient plumbing fixtures

## About Daikin AC

*Daikin AC offers North America intelligent heating and air conditioning 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.*

## Location

Private Residence  
Portland, Oregon  
USA

