

**Project:** *Bayne Residence*

**Client:** *Ted Bayne and Lea Delacour*

**Location:** *Martha's Vineyard Island, Massachusetts*

**Retrofit Challenge:** *How to integrate Daikin Altherma with an existing fossil fuel boiler / radiant heating system while ensuring winter comfort with minimum operating cost.*

Ted Bayne and Lea Delacour live on Martha's Vineyard in a 3,000 square foot home heated by radiant floors and a Viessmann propane boiler. Their goal was threefold – to find a heating source that would make their existing 90% efficient heating system more economical to run, would not involve destroying their extensive gardens with a geothermal installation, and would use electricity to operate – making their home ready for the “all-electric” island that Martha's Vineyard will become in the near future.

**The Solution:** *An innovative coupling of a Daikin Altherma system with the boiler that lets Daikin Altherma heat pump do most of the heating all winter long and turns on the boiler only on the coldest days.*

Until the arrival of Daikin Altherma, there was no realistic or cost effective way to meet these goals. Daikin Altherma provides geothermal levels of efficiency at a much reduced installation



cost and can operate all winter long. Ted and Lea contacted Nelson Mechanical Design (NMD) to design, engineer, and install an innovative heating system that would meet their three goals. NMD recommended Daikin Altherma as the solution that uses electricity, operates at geothermal efficiency levels, has a tiny outside footprint, and heats water for the home's radiant floors and domestic hot water system.

A Daikin Altherma outside condensing unit was connected through refrigerant lines to a hydrobox unit mounted inside (that extracts the heat from the circulating refrigerant for use in the hot water system). A Daikin motorized valve was installed to send hot water either to a Daikin domestic hot water tank or to the radiant heating system. A control system was installed to integrate the new Daikin Altherma heat pump with the existing Viessmann boiler.



*A 3,000 square foot home with Daikin Altherma as the solution that uses electricity, operates at geothermal efficiency levels of 200 to 400%, has a tiny outside footprint, and heats water for the home's radiant floors and domestic hot water system.*

**Innovation:** *Split up Domestic hot water and radiant heating*

This installation is innovative in several ways. The existing Viessmann boiler had been set up to heat the radiant floors and domestic hot water. NMD determined that the most effective way to use Daikin Altherma to meet these needs was to split the Daikin's radiant and domestic hot water output.

Above a selectable outside temperature, Daikin Altherma will do all of the domestic hot water heating and the Viessmann boiler will be off. Below this temperature, the Viessmann will do all of the domestic hot water heating and Daikin Altherma will be off. The two hot water tanks are connected together with automatic valves – when Daikin Altherma is making



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*- Brian Nelson, NMD*

domestic hot water, the Viessmann tank is serving as a pre-heat tank – likewise, when the Viessmann tank is on, the Daikin tank is the pre-heat tank. This means that all energy used to heat domestic hot water is never wasted, there is always plenty of hot water, and most of the time, the domestic hot water is made at heating efficiencies of 200% to 400% with Daikin Altherma.

Similarly, a selectable outside temperature also controls the radiant heating system. Above this temperature, Daikin Altherma does all of the radiant heating. Below this temperature, Daikin Altherma continues to provide hot water to the radiant floors, but the Viessmann boiler is allowed to add only what additional heat is necessary to maintain inside comfort. This lets Daikin Altherma work all winter long, providing heat to the radiant system while significantly reducing radiant heating costs.

**Innovation: A new approach to integration of Daikin Altherma with existing heating systems - "heat pump AND boiler"**

Daikin currently describes three ways to use Altherma – heat pump only, heat pump with back-up heater, and heat pump OR boiler. This installation adds a fourth way to the list – it uses the heat pump AND boiler all winter long. This increases the annual operating hours of Daikin Altherma (which increases the annual efficiency of the heating system), increases the value of the system

installation (instead of having the heat pump idle during parts of the winter, it now operates continuously), and reduces the homeowner's exposure to volatile fossil fuel prices (electricity costs change very slowly compared to propane costs over the heating season).

**Homeowner Satisfaction**

Ted and Lea have not noticed any change in their winter comfort, but their operating costs have been significantly reduced.

"When the Viessmann system and radiant heating became popular about 10 years ago, they were perceived to be the ultimate in heating comfort and efficiency. 10 years ago, 90% efficiency looked pretty good. But 90% efficiency is no longer good enough with today's energy prices – Daikin Altherma brings the efficiency of this system up towards 400%" said Brian Nelson, NMD.

He added, "It took some thought, but we cracked the "Viessmann code" and found a great way for Daikin Altherma to greatly reduce annual operating costs and bring this heating system into the 21<sup>st</sup> century - quietly, simply, and all winter long.



*A Daikin Altherma outside condensing unit was connected through refrigerant lines to a hydrobox unit (EKHBX054BA3VJU) mounted inside (that extracts the heat from the circulating refrigerant for use in the hot water system).*



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**Daikin AC Equipment**

- 1 (Model # EKHBX054BA3VJU) Hydrobox
- 1 (Model # ERLQ054BAVJU) Outdoor Unit
- 1 (Model # EKHWS080BA3VJU) Domestic Hot Water Tank