

Monroe, Georgia

KUNTZ RESIDENCE



CHALLENGE

Building a zero-energy-ready home with low energy loads and a tight thermal envelope

SOLUTION

Variable-Capacity Heat Pumps and prototype Heat Pump Water Heater from Mitsubishi Electric

RESULT

A highly-efficient, net zero home generating enough energy to offset the homeowner's usage

What would it be like to never pay a power bill again? Mark Kuntz, chief executive officer, Mitsubishi Electric Trane HVAC US (METUS), is well on his way to finding out. With a passion for high-performance building, Kuntz decided to put his knowledge to the test after buying an 11-acre property in Monroe, Georgia.

"Our goals for the home were threefold: We wanted to build a house that would consume zero energy, incur no debt and utilize materials that are long life and relatively maintenance free," explained Kuntz. An advocate for the technology and assured of its performance, Kuntz utilized Mitsubishi Electric's Zoned Comfort Solutions® for his new, low-load, energy-efficient and healthy home.

While the house had high-performance criteria, Kuntz knew with the right mechanicals and construction, he could achieve low loads and even net positive energy because he had encountered it before. Since joining the company in

2010, Kuntz recalls two significant experiences that piqued his interest in efficient building.

A HISTORY WITH MITSUBISHI ELECTRIC

"Early in my career with Mitsubishi Electric, I was in Chicago working with an architect, Tom Bassett-Dilley, on the first passive house in the city," explained Kuntz. "We had just installed two mini splits for the home when a 20-degrees-below-zero cold spell came through. After checking in on our customers, we found that they couldn't have been happier with the system."

Kuntz's second inspiration came from a client trip to Japan. A group of customers toured a fully electric, smart house that Mitsubishi Electric built in the city of Ofuna.

"The smart house incorporated all sorts of high-tech features. Among the most interesting to me, it had an electric car and charger that could go bi-directional," said Kuntz. "In the case of a grid outage, you could

back feed from the car battery and run it through the house to all the critical systems. Coupled with a solar array, you could do that for days on end. It was a great demonstration of how a fully integrated, high-performance house can be even more impactful to the owner.”

ASSEMBLING THE TEAM AND THE BUILDING ENVELOPE

With his vision clear, Kuntz set out to assemble his project team. With help from Mitsubishi Electric’s Performance Construction Team, a local custom home builder and energy rater, Imery Group, was selected for the job. Imery Group has been installing Mitsubishi Electric HVAC equipment since 2011 and

is dedicated to the green building movement.

“Everything we do as a company focuses on value and quality. Not only the economic value of a high-performance building but the social and environmental values to the greater community as well,” said Luis Imery, owner, Imery Group. After assessing Kuntz’s goals and the property, the team set their sights on building a DOE Zero Energy Ready Home. “This home recognition essentially means that we maximized our efforts and did everything we could to make the house as healthy and energy efficient as possible, prior to the incorporation of renewable energy,” explained Imery.



“ Mitsubishi Electric gives you the equipment size you need and the technology to vary the output up and down to match your load conditions. And it’s done in a way that’s compact, attractive and efficient. ”

— Mark Kuntz, chief executive officer, METUS



With these criteria in mind, the project team planned the thermal envelope and mechanical system design for the 1,863-square-foot, two-story home.

“For a home like this, you always start with the building envelope: the exterior walls, the roof and the foundation assembly,” noted Imery. “For Mark’s house, we wanted to have a continuous and air tight thermal envelope. That means insulation that goes around the foundation, the walls and the ceiling, all in a continuous form.”

Imery Group installed below-grade slab insulation to accommodate the horizontal plane of the house. As for the walls, they’re covered in ZIP System® R-Sheathing from Huber Engineered Woods and the studs are staggered in a zig-zag pattern. The home was further insulated with spray cellulose, a recycled paper product. The combination of these materials effectively prevents air leakage, allowing the mechanicals to perform optimally.

“The less wood you have touch the exterior of the home, the more efficient it will be, which is why we used the insulated sheathing and staggered stud walls,” noted Imery. “On a conventional 2x4 wall, you

typically place studs 16 inches on center. In this case, we did 2x6 walls (allowing us more insulation) and staggered the studs 24 inches on center for the exterior and 24 inches on center for the interior, off set 12 inches apart.”

Once assembled, the roof and walls were rated by an R-Value, or the rate by which a material’s heat flow resistance is measured. The walls were rated at R-28 and the roof, R-50, significantly higher than code requirements for new builds.

HIGH-PERFORMANCE HVAC DESIGN

Next up, was the HVAC design. The METUS Performance Construction Team and Imery Group brought in energy and HVAC consulting firm, Energy Vanguard, to collaborate on the layout and load calculations of the mechanicals.

“When you’re building any new home, calculating the heating and cooling loads is important to do from the start,” said Allison Bailes III, president, Energy Vanguard. “Room by room, you measure the loads so that you can then determine the total size of the equipment appropriate for the home. Then



there’s the ducting to factor in. Whether a system’s ducted or ductless, you’ll have to make sure air is distributed properly.”

Ultimately, the team decided upon three MSZ-FH Wall-Mounted Indoor Units (one for each bedroom) and one Horizontal-Ducted Indoor Unit (PEAD) to condition the first level of the home. Mitsubishi Electric’s mobile app and web service, kumo cloud®, was also installed so that

Kuntz and his family can control the comfort of the home from their preferred smart devices.

While Mitsubishi Electric HVAC equipment was already specified for this home going into the job, Bailes noted that it’s an ideal brand for high-performance homes and traditional homes alike.

“With the way codes are going and with energy programs pushing efficiency to higher and higher levels, it’s getting harder to serve homes with existing, conventional equipment,” said Bailes.

“Conventional equipment has a bottom end on the sizing and what we’re finding is that low-load homes go beyond that. Compared to the competition, Mitsubishi Electric also appears to have the best network of dealers, contractors and support.”

The Performance Construction Team is a big part of that superior support offering. “We serve in an advisory capacity,” explained Chad Gillespie, senior manager of performance construction, METUS. “Consumers today are extremely interested in having healthy homes and will pay to ensure that there are less contaminants such as radon, pesticides and so on. We



assist with the HVAC design and recommend other mechanical products that we trust to achieve our clients' goals. Our team works to provide optimal air quality and a truly healthy home." Imery Group also installed a third-party energy recovery ventilator, dehumidifier and photovoltaic solar panels based on their experience and recommendations from Gillespie and his team.

TAKING EFFICIENCY TO THE NEXT LEVEL

One other game-changing product was installed that further assists in making the home ultra-efficient: a prototype hot water heat pump from Mitsubishi Electric.

"The idea of this technology is not new. There are plenty of companies that have made similar systems, but those alternatives are integrated, meaning they pull heat energy from the space that surrounds the hot water heater," explained Kuntz. "There's zero net benefit to that. If you were operating a hot water heater with that kind of setup in the winter, all you're doing is stealing heat from the rest of the house and putting it in the water."

The prototype hot water and space conditioning heat pump from Mitsubishi Electric captures the heat from the outdoors so it isn't necessary for the HVAC system to compensate for the heat loss that might occur indoors. "So far, we've been getting good performance results. We're hitting the energy factor level that a lot of utilities are looking for with hot water heat pumps," said Kuntz. "It's a split system, half outdoors (so it's not cannibalizing heat) and half indoors to provide both hot water and heating and cooling to the rest of the downstairs space. When in air-conditioning mode, it's capturing heat inside the house and putting it in the water; it's essentially gathering free heat."

Taking a cue from the Ofuna smart



home, Kuntz also had an electric car charging station installed in the garage and in the future, plans to add a bi-directional charger. "My expectation is to provide living and transportation energy on a net-zero basis," said Kuntz. "With the solar panels installed, the expectation is that my energy generation will offset my usage, including my electric vehicles." Bailes notes that benefits like these are why more homeowners should consider the green building movement.

"When you have an all-electric home and it has a very low-load, utilizing photovoltaic panels on the roof makes it a lot easier to bring that home to the zero-energy level," said Bailes. "If the loads are low enough, you can actually have extra

electricity (this is called net positive) and that extra electricity can be used for all sorts of other helpful purposes like charging electric cars."

Since the home's completion in December 2018 and review by a third-party green verifier, Home Performance Solutions, the residence has exceeded the entire project team's expectations. "With the solar panels, the home has a confirmed HERS score of -13. For a conventional, new build home, RESNET references a HERS score of 100 and the Georgia Building Code goes even further, requiring a HERS index of 90. This is a terrific result for Mark," said Imery. The home also officially meets DOE Zero Energy Ready Home, ENERGY STAR®, EPA Indoor airPLUS and EarthCraft™

certifications and exceeds the 2009 and 2012 International Energy Conservation Code® (IECC). In addition, with the solar panels, Kuntz’s projected energy costs per year total \$120. That’s an annual savings of \$2,837 compared to the average, new U.S. home. According to the Zero Energy Project, the total cost of ownership of a zero-

energy-ready home is less than that of a similarly sized, conventional new home – not to mention, an environmentally-conscious decision.

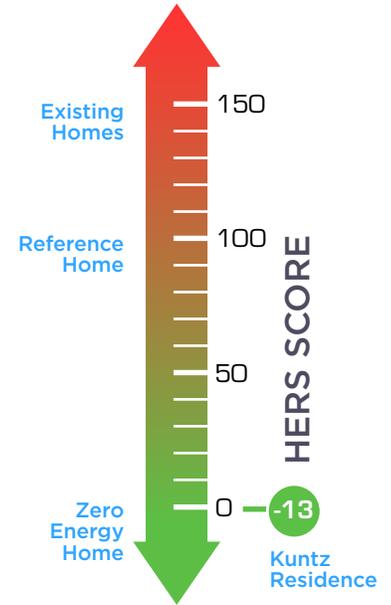
With such great energy savings, Kuntz can’t help but advocate for performance building and utilizing Mitsubishi Electric’s Variable-Capacity Heat Pumps. The proof is in

the results.

“The whole notion of creating a home like this is that you can reap the benefits of no energy costs, low maintenance and extremely comfortable conditions without giving up window space, airy rooms and nice design,” said Kuntz.

ESTIMATED ENERGY USAGE

	Use [MBtu]	Annual Cost
Heating	5.3	\$196
Cooling	1.8	\$65
Hot Water	3.3	\$122
Light/Appliances	19.8	\$735
Service Charges	—	\$120
SUM	30.2	\$1,238
Generation (e.g. Solar)	38.7	-\$1,118
TOTAL	+8.5 GAIN	\$120



PROJECT TEAM

Builder/Installer:

Imery Group, Athens, Georgia

HVAC Engineer:

Energy Vanguard, Decatur, Georgia

Consultant:

METUS Performance Construction Team

Energy Rater:

Home Performance Solutions, Athens, Georgia

EQUIPMENT

- ▶ (3) MSZ Wall-Mounted Indoor Units
- ▶ (1) MXZ Multi-zone Outdoor Unit
- ▶ (1) PEAD Horizontal-Ducted Indoor Unit
- ▶ (3) PAC Wireless Interfaces
- ▶ (1) PUZ Hot Water Heat Pump and Space Conditioning Outdoor Unit Prototype