

Amaris Custom Homes

St. Paul, Minnesota



BUILDER PROFILE

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FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: Amaris Homes Model
- Location: St. Paul, MN
- Layout: 5 bedrooms, 4 baths, ranch with finished basement
- Conditioned Space: 3,542 ft²
- Climate Zone: IECC 6, Cold
- Completion: September 2013
- Category: Custom

Modeled Performance Data:

- HERS Index without PV 41, with PV 4
- Projected total annual energy cost savings (compared to a similar house built to the 2006 or 2009 IECC): with PV \$3,805, without PV \$2,388
- Projected annual utility costs: with PV \$278, without PV \$1,713
- Annual PV production revenue: \$1,435
- Estimated annual energy consumption:
 - With PV: electricity 0 kWh, natural gas 726 therms
 - Without PV: electricity 9,166 kWh, natural gas 744 therms

“We call it common-sense building,” says Ray Pruban, founder and chief manager of Amaris Custom Homes. “We constantly pursue an understanding of how the built systems will operate and perform together and carefully incorporate products and procedures into the homes we build in a way that makes common sense for our customers.” By applying this common-sense approach to custom building, Amaris has become a market leader in green homes that are energy-efficient, safe, healthy, and durable.

For this project, Amaris worked with U.S. Department of Energy (DOE) team NorthernSTAR Building America Partnership to approach zero energy in Minnesota’s cold climate using reasonable, cost-effective, and replicable construction materials and practices. The result is a passive solar superefficient 3,542-ft² walkout rambler with all the creature comforts. Amaris built this home to DOE’s Zero Energy Ready Home standards—the first in Minnesota—and achieved certifications for Leadership in Energy & Environmental Design for Homes v4, MN Green Path–Emerald, and a Builders Association of the Twin Cities Reggie Award of Excellence. The home achieves a Home Energy Rating System (HERS) score of 41 without photovoltaic (PV) panels. When 10.5 kW of PV panels are added, the home achieves a HERS score of 4. Its projected annual utility costs are \$1,713 without PV; with PV, only \$278.

The south-facing lot is perfectly suited to the requirements of passive solar design, and the home is oriented within 15 degrees of due south. The viewing deck and the overhangs were designed to shade the south-facing windows throughout the summer months and to let the sun warm the home in the colder months. Thermal mass flooring and tile on both floors absorb heat during the day and release heat at night; custom barnwood doors help control heat gain in the swing seasons.

The long shallow home design was created to accommodate the planned 10.5-kW PV system, which was designed to be completely hidden from neighbors. The roof is pitched differently front to back to allow for a third row of solar panels. The 10.5-kW



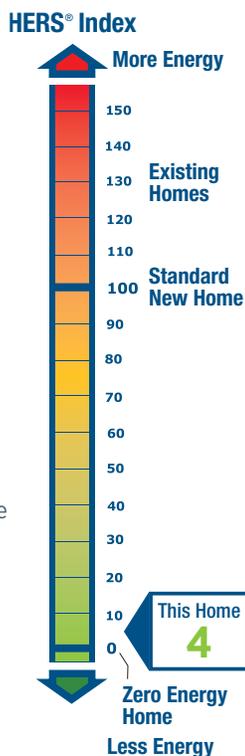
The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE’s Zero Energy Ready Home program (formerly known as Challenge Home). Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0 for an energy-efficient home built on a solid foundation of building science research. Advanced technologies are designed in to give you superior construction, durability, and comfort; healthy indoor air; high-performance HVAC, lighting, and appliances; and solar-ready components for low or no utility bills in a quality home that will last for generations to come.

The home's south-facing windows allow the winter sunlight to warm the thermal mass flooring on both floors for passive solar heating (right). Custom barnwood doors control heat gain in swing seasons (below).



WHAT MAKES A HOME DOE ZERO ENERGY READY HOME-CERTIFIED?

- 1 **BASELINE**
certified ENERGY STAR® for Homes Version 3.0
- 2 **ENVELOPE**
meets or exceeds 2012 IECC levels
- 3 **DUCT SYSTEM**
located within the home's thermal boundary
- 4 **WATER EFFICIENCY**
meets or exceeds the EPA WaterSense Section 3.3 specs
- 5 **LIGHTING AND APPLIANCES**
ENERGY STAR qualified
- 6 **INDOOR AIR QUALITY**
meets or exceeds the EPA Indoor airPLUS Verification Checklist
- 7 **RENEWABLE READY**
meets EPA Renewable Energy-Ready Home.



solar system will provide most of the electricity needs and will be grid-tied to Internet and smartphone monitoring capabilities.

The home is built with R-24 insulated concrete form basement walls and R-20 basement slab insulation. Exterior walls are 2×6 and 24 in. on center, which reduces studs and increases wall insulation (typically 25% or more). U-corners and single-ply headers are used to remove common insulation gaps. Amaris used R-5 continuous rigid exterior insulation to reduce thermal bridging with R-21 closed-cell wall cavity insulation for a combined R-26. The attic is constructed with an energy heel truss, and the ceiling is air sealed with R-14 closed-cell spray foam with an additional R-48 fiberglass for a total ceiling insulation of R-60. All ceiling penetrations are sealed and insulated with R-5 foam boxes before the closed-cell spray foam is applied. Amaris focused on air-sealing details during construction with all wood-to-wood connections in exterior walls glued to minimize air infiltration, low expanding foam sprayed in rough openings around windows and doors, and an insulated and airtight prefabricated attic access panel to achieve an airtightness level of 464 CFM50.



Amaris also builds its homes to withstand higher wind events than those required by code because tornadoes occasionally occur in the area.

Amaris includes construction features that meet U.S. Environmental Protection Agency (EPA) Indoor Air Quality Plus requirements to support a clean and healthy indoor environment. Ninety percent of the flooring is hard surface, and the small amount of carpet is formaldehyde-free.

This is accomplished by attaching the entire exterior structure (exterior walls, floor, and roof trusses) to the poured wall foundation with specially designed metal strapping. The closed-cell insulation in the exterior walls increases sheer (lateral) strength. The company also uses upgraded hold-downs and reinforced garage doors. All these systems work together to protect the home from high wind events.

All the home's windows are double-pane low-e with high insulation values of U-0.27 and optimized for solar heat gain by orientation. Large roof overhangs minimize summer solar heat gain. "A comfortable home environment doesn't happen by accident. We try to maximize the home's comfort by planning every detail of your home very deliberately. We evaluate every factor that contributes to occupant comfort, starting with the building and window orientation to maximize natural light," said Pruban.



Roof overhangs, decks, and cantilevers provide shading during the summer (above). Radiant in-floor heat on nine separate zones, domestic hot water, forced-air, and backup heat are provided by a 95% efficient boiler (right).



The home's heating, ventilating, and air-conditioning (HVAC) system is based on radiant in-floor heat with nine separate zones (which also provide thermal mass with tile for passive solar). It has a 110,000-Btu, 95% efficient boiler that provides domestic hot water and in-floor heat. A forced-air, 95% efficient, two-stage, fully modulating furnace on two electronic zones provides backup heat.

The home functions on passive solar heat in the swing seasons. The air conditioner is 16 seasonal energy efficiency ratio (SEER). System controls include indoor air quality thermostats with Wi-Fi access. The domestic hot water is supplemented with a double-wall indirect water heater to serve small demand loads without turning on the boiler.

Amaris demonstrates its commitment to the comfort and health of its clients by carefully considering construction features that will support a clean and healthy indoor environment. This includes meeting the EPA Indoor Air Quality Plus requirements and installing a Venmar energy recovery ventilator for fresh air management. The home also includes a minimum efficiency reporting value-rated 16 air filter that can filter particles as small as 0.3 microns. All ducts are rigid metal (supplies and returns) and sealed with mastic. Measured duct leakage to the outside is 5 CFM25. An active radon system includes 50% more subslab gas-permeable material than required. Intermittent ventilation is met with low-sone bath fans controlled by motion detection. The attached garage also has a motion-activated fan to exhaust pollutants. The kitchen range vent is ducted to the outside. Ninety percent of the flooring is hard surface, and the small amount of carpet is formaldehyde-free. Low-volatile organic compound (VOC) glues and no-VOC/low-VOC paints and varnishes were specified. As a result of this exceptional attention to indoor environment, Amaris is recognized by the Minnesota Department of Health as a Gold Standard Builder.

Amaris uses water-efficient products indoors and out. The home's plumbing system is designed to meet all EPA WaterSense requirements, including WaterSense-certified, dual-flush toilets and low-flow lavatory faucets and showers. A recirculation pump with timer controls ensures hot water delivery with minimum wait time.

The landscaping was designed to reduce outdoor water demand by 25% with drought-tolerant turf and 90% drought-tolerant plants. An EPA WaterSense professional designed the irrigation system, which includes drip irrigation in all the planting beds and an irrigation controller with a moisture/rain delay sensor.

Appliances and ceiling fans are all ENERGY STAR-rated and the lighting is 100% light-emitting diodes or compact fluorescent lamps.

HOME CERTIFICATIONS

First DOE Zero Energy Ready Home in Minnesota

ENERGY STAR Version 3.0

MN Green Path—Emerald

Leadership in Energy & Environmental Design for Homes v4 Beta—Silver

Builders Association of the Twin Cities Reggie Award of Excellence

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Every DOE Zero Energy Ready Home combines a building science baseline specified by ENERGY STAR Certified Homes with advanced technologies and practices from DOE's Building America research program.

The home design supports age-in-place possibilities. The barrier-free front entry and oversized interior doors accommodate wheelchairs and the master shower offers a zero-barrier walk-in shower. The main floor features single-level living with a master suite and a second bedroom smartly located in the rear to offer privacy and south-facing sunlight. This can be configured as a study, guest bedroom, snore room, morning sitting area, or studio.

The lower level offers flexible configuration possibilities for today's changing lifestyles. The Jack and Jill bedrooms are ideal for teenage children or the boomerang adult child with a baby. The oversized fifth bedroom could serve as a home office or mother-in-law bedroom (with conversion of the half bath to full bath).

Amaris Custom Homes keeps construction costs competitive with a transparent business model. Its project books are completely open to the clients, including all takeoffs, estimates, invoices, overhead costs, and profit line items. This total transparency removes any question or doubt about costs or project status. Amaris works closely to help its trade partners with detailed scopes of work and project specifications, and each



The kitchen features an ENERGY STAR-rated dishwasher and refrigerator. The range vent is ducted to the outside.

project begins with a mandatory preconstruction meeting to review the plans, specifications, and schedule. Every home also receives third-party inspections.

Amaris has embedded high-performance principles into its everyday building practices and has committed to building 100% of its homes to meet the requirements of DOE's Zero Energy Ready Home program.

"Saving money every month on

energy and utility bills means having extra money each month for other things more important to our clients. Because they are using less energy, they automatically reduce their carbon footprint too," said Pruban.

Building Knowledge, Inc., a team lead for DOE's NorthernSTAR research team, provided energy modeling and analysis for the major building systems, including windows, foundation insulation, HVAC, and water-heating specifications. This analysis provided Amaris with the cost-benefit data that guided its specification choices. According to Pruban, "working with the NorthernSTAR team was an 'invaluable resource to make decisions' and 'changed a lot about what we do' at Amaris Custom Homes."

Building Knowledge, Inc., also provided quality assurance verifications and performance testing throughout the construction of the project. A major focus for the project was on reducing duct leakage. The team used a fog machine and Duct Blaster to identify duct leaks with the HVAC contractor present to mastic the areas that needed additional sealing.

Pat O'Malley, director of operations of Building Knowledge, noted that at Amaris Custom Homes, "...commitment to continuous improvement and attention to detail makes it easier to achieve the builders' goals for meeting the high-performance criteria of the Zero Energy Ready Home program."

KEY FEATURES

- **Zero Energy Ready Home Path:** Performance
- **Walls:** 2×6 walls, 24 in. on center, 1-in. continuous rigid exterior insulation, 3-in. closed-cell wall cavity insulation, total wall R-26. House wrap, engineered wood siding
- **Attic:** Energy heel truss, 2-in. closed-cell spray foam on lid with R-48 blown fiberglass, total R-65.5
- **Foundation:** Basement, 14-in. insulated concrete form, R-24
- **Windows:** Double-pane, argon-filled; polyvinyl chloride-framed; low-e windows with U-0.25 and 0.49 solar heat gain coefficient.
- **Air sealing:** 464 CFM50
- **Ventilation:** Energy recovery ventilator, motion-detector-controlled exhaust fans
- **Hot water:** 95% efficient boiler provides domestic water, in-floor heat, and forced-air backup heat
- **HVAC:** 95 annual fuel utilization efficiency furnace, 16 SEER air conditioner (ducts in conditioned space)
- **Lighting:** 90% light-emitting diodes, 10% compact fluorescent lamps
- **Appliances:** ENERGY STAR dishwasher, clothes washer, and refrigerator
- **Solar:** 10.5-kW PV
- **Water conservation:** Landscape designed to reduce demand by 25%, drought-tolerant turf, 90% drought-tolerant plants
- **EPA WaterSense fixtures:** Lavatory faucets and showers
- Wegowise utility tracking and benchmarking
- **Other:** Passive solar design, thermal mass flooring.

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