Man builds most energy-efficient home he could

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Saving money was never on Dennis Kaech's mind when he built his Olympia, Wash., home. But saving energy was.

"I wanted to see how many crazy things you could put in a house," Kaech said on a recent winter day in his light-filled home on the city's west side.

By "crazy things" he means energy producers and heat conservers. Kaech, 69, is a retired high school science teacher. Fun for him is a day spent calculating how many kilowatts he can save with a new heating system.

Kaech has spent $350,000 on the house. But it's not a gold plated palace with luxe finishings. The money is inside the walls, under the floors and on the roof. He wanted to build the most energy-efficient home he possibly could. He appears to have succeeded.

"I'd probably get 50 cents on the dollar," Kaech said of his investment - if he sold it today.

The home features a windmill, solar panels, passive heat storage and enough insulation for a colony on Mars.

Kaech bought the property in 1978 but didn't begin construction until 2008 after tearing down the previous home on the site. In November, he moved in.

The house is open and inviting - mostly. Directly behind a bank of south-facing windows is a formidable rock wall. It's not some horrible blueprint screw-up. Kaech designed the house that way. The rock wall, recycled from the previous house's chimney, is heated by solar rays and by a wood burning stove. In the evening, the wall releases heat back into the house.

They aren't the only heat-holding rocks in the house. A concrete box underneath the living room holds more than four tons of rock. It absorbs excess heat and then releases it as the house cools.

The walls of the wood-framed home are built like a layer cake. Underneath HardiePlank siding is a layer of foam insulation acting as a thermal break, followed by house wrap over subpaneling. Inside the 2-by-6 framing, Kaech installed 4-inch batts of fiberglass insulation and had a 2-inch layer of blown-in foam insulation. Lastly, sheetrock followed.

The walls have a total combined R-value of 31. R-value is a measure of a material's ability to block heat transfer. The higher the R-value the better the insulation is. Building codes require a minimum of R-20 for exterior walls. For his north and west facing walls Kaech used prefabricated insulated panels manufactured by Premier Panels of Fife. He also minimized windows in the north walls—an energy saving move.

The downstairs holds a modest living room, kitchen, bathroom and garage while the upstairs holds his loft bedroom, bathroom and a separate living area. The living space totals 1,400 square feet.

Both levels have 2-inch thick concrete floors. Hidden in them are 0.5-inch wide tubes filled with water that provide radiant heat. A water heater, set at 105 degrees, is dedicated to the system. Ceiling fans push heat back down toward the living spaces.

Complicated enough yet? It's only the beginning. The radiant heat system and domestic water supply are both heated using geothermal technology. It's not the kind of steaming hot geothermal you see at Yellowstone. The system uses plain old Olympia ground heat.

Four horizontal holes were drilled on Kaech's property and filled with tubes containing water. It's a closed loop system that absorbs heat from the ground (which is usually at 50 degrees) and then, using a heat pump, transfers the energy to the radiant heat and domestic hot water systems. Think of it as the opposite of a refrigerator.

"It only raises the tank 5 or 6 degrees per hour," Kaech said. But that's enough to get the hot water tank to 115 degrees. That may be enough for a shower but not to do dishes. Not to worry: he has a backup - or two.

A set of solar panels on the roof runs heated water (up to 200 degrees even in January) to a transfer system (another closed loop) that heats the domestic water system in conjunction with the geothermal. A third and final backup is provided by standard electrical coils.

Those aren't the only solar panels on Kaech's roof. Panels of photovoltaic cells produce 4,680 kilowatt hours of electricity per year.

In the summer Kaech's system creates more electricity than he can use. The excess is sent to the power grid. Puget Sound Energy doesn't pay customers for excess kilowatts but they will credit accounts - making a battery superfluous. In the winter, when short grey days produce less electricity, Kaech can use those banked kilowatts.

A look over Kaech's bills shows the results. In December 2012 PSE delivered 584 kWh while his system produced 81 kWh. But in August Kaech's system produced 663 kWh. (Kaech was not yet living in the house in August and PSE delivered only 99 kWh).

Banked kilowatts - if there are any - are zeroed out in April. But Kaech said he'll never be a net producer. He expects the panels, over the course of a year, to provide half of his electricity needs.

The entire solar system cost Kaech $36,000 for parts and installation. That might seem like a high up-front cost but when one starts to do the math the figure doesn't seem so daunting.

First, the federal government gave Kaech a 30 percent tax credit off the installation costs. Additionally, because the solar system was manufactured in Washington (by Silicon Energy of Marysville), for every kilowatt he produces until 2020 the state (via PSE) pays him 54 cents. In the most recent year-long period he made $2,611.

Solar energy is often thought of as clean energy (compared with emission spewing power plants) but its production is not necessarily so.

"It's green in theory but to build a silicon cell takes a lot of energy," Kaech said.

A windmill that rises above the home was supposed to add to the green electrical system but it has never functioned correctly. It's a sore point for Kaech - one of the home's few failures.

What is green in Kaech's home is his sewer system. The home has two effluent lines. A grey line drains bathroom sinks, tubs, showers and washing machines while a black line drains toilets, kitchen sinks and dishwashers. The grey line feeds into a 1,000 gallon cistern (along with rainwater from gutters) that can be used to water landscaping. The black line goes to the city's sewer system.

While the rest of us sweat over heating bills Kaech reclines in his 75 degree home, heated only by his wood stove and an occasional morning

boost from the radiant floor system. He only has one regret.

"I should have built it when I was younger."