University of Missouri

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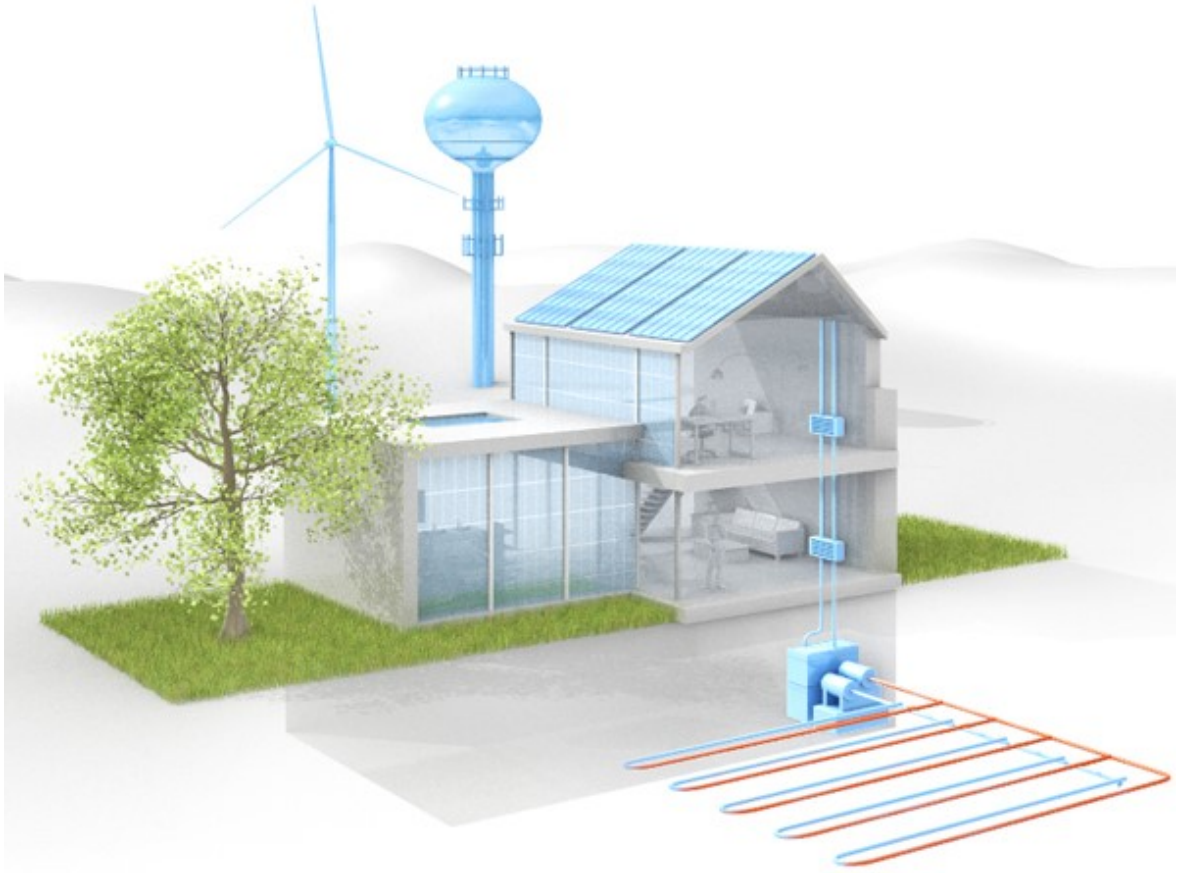
Home of the future

Making buildings more energy-efficient

Story by Tara Ballenger | Illustration by Brian Christie Design

MU researchers are working on the next generation of sustainable energy technology. Here's a peek at how those innovations might change our homes in years to come.



Super-efficient solar

Who? A team of researchers, including MU chemical engineering Professor Patrick Pinhero and scientists at the Idaho National Laboratory, the University of Colorado and a private tech company in Cambridge, Mass.

What? A flexible solar panel capable of harvesting more than four times as much of the sun's energy as today's solar cells.

How does it work? Pinhero's tiny "nantenna," made in various microscopic sizes, absorb certain wavelengths of light that correspond with their size. This allows the team to customize the nantenna to any aspect of the light spectrum. Working together, the various sizes can potentially absorb as much as 90 percent of the light spectrum.

What makes it cool? The team places nantennas on thin, pliable sheets that could eventually be incorporated into shingles and other building materials, meaning that roofs of the future would do a lot more than just keep out the rain. The same technology may also be used to power cars and electronics.

When will it be available? Prototypes could be available within five years.

Wind power

Who? Atmospheric scientist Neil Fox and engineering Professor Noah Manring

What? A system to store wind energy by pumping water into a water tower so it can be used for later hydroelectricity production.

How does it work? The cycle starts when wind turns the blades of the windmill, powering a turbine that pumps water into a tower for storage. To produce energy later, the water is released, driving another turbine that creates electricity similar to a small-scale dam.

What makes it cool? Today, wind energy must be piped to the grid as soon as it's produced. Storing the energy would allow users to save for when the wind doesn't blow — wind power harnessed during winter gale could run air conditioning on a windless summer. According to Fox, the water tower method could be a boon for rural towns burdened with steep electricity rates.

When will it be available? Fox is analyzing wind data from across the state to find the best place for the team to construct a turbine and test the idea. Meanwhile, Manring and Fox are working with an economist to determine if the concept would be a financially feasible option for small towns.

Organic solar cells

Who? Physics Professor Suchi Guha

What? Thin, flexible solar cells that can be used to make electricity or light.

How does it work? Traditional photovoltaic solar cells are made of silicon, but that's not the only element that can use the sun to make energy. When the right combinations of carbon-based molecules are sandwiched between two electrodes, they create electricity. Some organic molecules are also photoluminescent — the sun's energy causes them to glow, creating a potential light source.

Guha is tinkering with the composition of those molecules to find the best ones for generating light and electricity. She designs various combinations of atoms that an outside lab assembles to her specifications. Back at MU, Guha tests them to identify which combinations increase the film's efficiency.

What makes it cool? The sheets are thin enough to be installed over entire rooftops or just in awkward crevices unreachable by traditional solar cells. They could power anything from cellphones to iPods. When photoluminescent cells are affixed to windows, the translucent sheets let in natural sunlight by day and emit their own illumination by night.

When will it be available? Organic solar cells may be in the market very soon.

Geothermal

Who? Environmental engineer Shawn Xu

What? A cheaper way to install underground geothermal units

How's it work? The key element of geothermal heating and cooling systems is a network of water-filled underground pipes. Because temperatures remain fairly stable beneath the Earth's surface, soil surrounding the pipes cools the water in summer and warms it in winter. The system still requires electricity to further cool or heat the water to the optimal temperature before pumping it through ducts in the home's ventilation system, though it's just a third of what traditional systems require.

Instead of placing pipes in deep holes, Xu's installation method puts them parallel to the surface at a much shallower depth. Because the boring of deep vertical holes accounts for most of the time and labor of installation, eliminating that step cuts costs by about 30 percent. Xu adds to those savings by installing the pipes under building foundations and driveways before housing construction begins.

What makes it cool? Xu's construction techniques are simple — plan ahead and avoid unnecessary digging — but they can cut the cost of installing a geothermal unit by as much as half. Drilling less is especially valuable in places like Missouri, which is riddled with rocky soil in many areas.

When will it be available? Xu has put his design to use at industrial and commercial sites all over the world. Although his work focuses on large-scale projects, his techniques could offer more affordable services to residential landowners.

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