Northeastern Startup Turns Cool Idea Into Greener Alternative To Air Conditioning

Northeastern University

A technology invented at Northeastern University is poised to provide an environmentally friendly alternative to air conditioning systems for homes and other buildings—a cool idea that began with an overflowing paper recycling bin and a blender.

Air conditioners and other compressor-based cooling systems account for about one fifth of the world's electricity use—in the US alone, $29 billion is spent annually on cooling homes—and contribute significantly to greenhouse gas emissions. Yi Zheng, PhD, an associate professor of mechanical and industrial engineering at Northeastern, and his startup company, Planck Energies, are addressing this problem with a highly reflective, ultra-white paint that helps keep buildings cool passively.

Northeastern's Center for Research Innovation (CRI) licensed the technology to Planck and is providing expert guidance on market entry, team formation and fundraising through the university's venture accelerator, Ignite. Successfully utilizing these resources, Planck has hired its first full-time engineer and in August 2023 won a coveted National Science Foundation (NSF) Small Business Innovation Research (SBIR) Phase I Award of $275,000.

This technology's story began when Zheng spied a blue recycling bin overflowing with white printer paper and started to envision how recycled paper itself could potentially be used to keep buildings cool and help fight climate change in

the process.

Zheng took the printing paper, stuck it in his high-speed household blender and started experimenting with the resulting paste. He discovered that adding hydroxyapatite (an abundant calcium-based natural mineral) fibers to the paste created a nontoxic, reusable, self-cleaning material that could reflect sunlight, draw out heat, shed water and retard fire. He dubbed this new material "cooling paper" and began testing its viability as a rooftop cooling system.

When applied, the paper reduced internal building temperature by as much as 10°F, even during midday. By redirecting 99% of sunlight and absorbing heat generated by bodies, machines and other processes within a building, Zheng's innovation reduced energy consumption by up to 25% without the use of electricity or hazardous coolants—factors that are particularly relevant in under-resourced areas.

"With heat waves on the rise, finding a more viable cooling approach is of paramount importance," Zheng said. "Cool roof technology is extremely well suited to these scenarios due to its low cost and off-grid capability, so we are very driven to apply it in these environments."

An NSF CAREER Award of $500,000 in 2019 helped support Zheng's initial research. The CRI at Northeastern proactively secured patent protection and awarded Zheng $100,000 through the Spark Fund, CRI's technology accelerator.

Although cooling paper was first incorporated into roofing materials, a collaboration with 3M demonstrated that the most effective commercialization pathway involved integrating the

substance into exterior paints. The SBIR grant will allow the team to refine the product, manufacture enough for pilot testing and assess its cooling performance and durability.

"Moving an idea from conception to commercial product is absolutely rewarding," said Jennifer Boyle-Lynch, CRI's Executive Director. "Technology transfer is a complicated enterprise, and seeing it come to fruition is inspiring."

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