

Researchers find ways to reduce computing energy consumption while saving money

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Lowering energy consumption associated with computer data storage (specifically, cloud computing) and saving millions of dollars are possible now, thanks to new memory technology, a field that researchers at the University of Pittsburgh have been exploring through a four-year, \$1.9 million grant from the National Science Foundation (NSF) awarded in 2009 titled, "Large: Storage Class Memory Architecture for Energy Efficient Data Centers."

Despite its advantages, cloud computing still requires extreme amounts of power; data centers around the world use 100 billion kilowatts per year, according to the [Environmental Protection Agency](#). Pitt's research team—professors and students from the Kenneth P. Dietrich School of Arts and Sciences' Department of Computer Science and the Swanson School of Engineering's Department of Electrical and Computer Engineering—has demonstrated how to effectively produce large amounts of [memory](#) while maintaining low electricity usage.

"Unfortunately, today's memory technology—dynamic random-access memory (DRAM)—is rapidly reaching its limit in power consumption and capacity for data-center-sized applications," said Bruce Childers, Pitt associate professor of computer science and principal investigator on the project.

With the growing demand for faster, more reliable memory technology, Pitt researchers have combined a smaller DRAM (for fast retrieval) with a larger, slower phase-change memory called PCM, a new technology

similar to but faster than the flash drives used in a computer's USB port. The result is a memory system that is fast enough for most software programs and more storage space; it also drastically reduces power consumption.

"Pitt's innovations in memory circuits have led to an eight-fold reduction in power cost," said Childers. "These innovations have also improved PCM lifetime, permitting this technology to last long enough for several years of usage in a data center, something that was not possible previously."

The tools developed throughout the project will continue to have an effect through a tutorial and software release planned at the "Symposium on Microarchitecture," one of the premier forums for presenting, discussing, and debating techniques for advancing computing systems. Working closely with industry leaders, Pitt is developing an operational prototype, "memory of the future," for use in data center computers.

Members of the Pitt research team are, in addition to Childers, Sangyeun Cho, associate professor of computer science; Daniel Mosse, professor and chair in the computer science department; Rami Melhem, professor of computer science; Jun Yang, associate professor of electrical and computer engineering; and Youtao Zhang, associate professor of [computer science](#). Six Pitt graduate students will assist the faculty researchers.

For the remaining two years of the grant, the team plans to expand on solutions related to [energy consumption](#).

Provided by University of Pittsburgh

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