Advanced Research Projects Agency • ENERGY

BEETIT PROJECT

UCLA

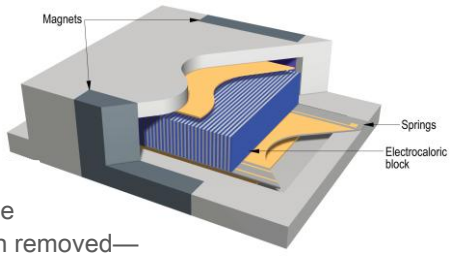
COMPACT SOLID STATE COOLING SYSTEMS

PROJECT TITLE:	Compact MEMS Electrocaloric Module		
ORGANIZATION:	University of California, Los Angeles (UCLA)	LOCATION:	Los Angeles, CA
PROGRAM:	BEETIT	ARPA-E AWARD:	$520,547
TECH TOPIC:	Building Efficiency	PROJECT TERM:	10/1/10 – 3/31/12
WEBSITE:	www.universityofcalifornia.edu/regents		

CRITICAL NEED

More efficient cooling methods are needed to reduce building energy consumption and environmental impact. Buildings account for 72% of the nation's electricity use and 40% of our carbon dioxide (CO_2) emissions each year, 5% of which comes directly from air conditioning. The refrigerants used in air conditioning are potent greenhouse gases (GHGs) that may contribute to climate change. Because most cooling systems run on electricity, and most U.S. electricity comes from coal-fired power plants which produce CO_2, there is a need to increase the efficiency of these technologies and reduce the use of GHG refrigerants.

PROJECT INNOVATION + ADVANTAGES



UCLA is developing a novel solid-state cooling technology to translate a recent scientific discovery of the so-called giant electrocaloric effect into commercially viable compact cooling systems. Traditional air conditioners use noisy, vapor compression systems that include a polluting liquid refrigerant to circulate within the air conditioner, absorb heat, and pump the heat out into the environment. Electrocaloric materials achieve the same result by heating up when placed within an electric field and cooling down when removed—effectively pumping heat out from a cooler to warmer environment. This electrocaloric-based solid state cooling system is quiet and does not use liquid refrigerants. The innovation includes developing nano-structured materials and reliable interfaces for heat exchange. With these innovations and advances in micro/nano-scale manufacturing technologies pioneered by semiconductor companies, UCLA is aiming to extend the performance/reliability of the cooling module.

IMPACT

If successful, UCLA would eliminate the use of polluting refrigerants in air conditioners used in buildings.

- SECURITY: Increased energy efficiency would decrease U.S. energy demand and reduce reliance on fossil fuels—strengthening U.S. energy security.
- ENVIRONMENT: Refrigerants with polluting emissions could account for up to 10%-20% of global warming by year 2050. UCLA's technology could eliminate the use of these refrigerants.
- ECONOMY: Widespread adoption of this technology could reduce energy consumption for air conditioning of buildings—providing consumers with cost savings on energy bills.
- JOBS: As new technologies develop, there will be new job opportunities in the design, installation, testing, and maintenance of efficient heating and cooling systems.

CONTACTS

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