Advanced Research Projects Agency • ENERGY

BEETIT PROJECT

PENNSYLVANIA STATE UNIVERSITY

HELIUM-BASED SOUNDWAVE CHILLER

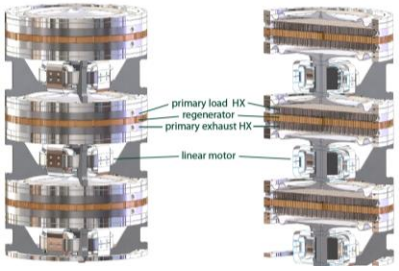
PROJECT TITLE:	Trillium: A Helium-Based Sonic Chiller- Tons of Freezing with 0 GWP Refrigerants		
ORGANIZATION:	Pennsylvania State University (Penn State)	LOCATION:	State College, PA
PROGRAM:	BEETIT	ARPA-E AWARD:	$2,908,239
TECH TOPIC:	Building Efficiency	PROJECT TERM:	9/1/10 – 8/31/13
WEBSITE:	www.acs.psu.edu/thermoacoustics/refrigeration		

CRITICAL NEED

New and more efficient refrigeration methods are needed to reduce building energy consumption and environmental impact. Buildings currently account for 72% of the nation's electricity use and 40% of our carbon dioxide (CO_2) emissions each year, 1.5% of which comes directly from commercial refrigeration. In addition, the refrigerants used in refrigeration technologies are potent greenhouse gases (GHGs) that may contribute to global climate change. Because the majority of refrigeration systems run on electricity, and most U.S. electricity comes from coal-fired power plants which produce CO_2, there is a pressing need to support improvements that increase the efficiency of these technologies and reduce the use of GHG refrigerants.

PROJECT INNOVATION + ADVANTAGES

Penn State is designing a freezer that substitutes the use of sound waves and environmentally benign refrigerant for synthetic refrigerants found in conventional freezers. Called a thermoacoustic chiller, the technology is based on the fact that the pressure oscillations in a sound wave result in temperature changes. Areas of higher pressure raise temperatures and areas of low pressure decrease temperatures. By carefully arranging a series of heat exchangers in a sound field, the chiller is able to isolate the hot and cold regions of the sound waves. Penn State's chiller uses helium gas to replace synthetic refrigerants. Because helium does not burn, explode or combine with other chemicals, it is an environmentally-friendly alternative to other polluting refrigerants. Penn State is working to apply this technology on a large scale.



IMPACT

If successful, Penn State would have thermoacoustic freezers available in the market to increase the supply of environmental friendly energy efficient cooling technologies.

- SECURITY: Improvements in refrigeration 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. Penn State's technology could eliminate the use of these refrigerants from commercial refrigeration systems.
- ECONOMY: Widespread adoption of this technology could reduce energy consumption in commercial refrigeration systems—providing commercial entities with cost savings on energy bills, which ultimately can be passed onto the consumers.
- JOBS: As new technologies develop, there will be new job opportunities in the design, installation, testing, and maintenance of efficient refrigeration systems.

CONTACTS

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