



## TECHNOLOGY

# Novel Vapor Compression Refrigeration and Heat Pump Systems

## OVERVIEW

Vapor compression refrigeration and heat pump systems using natural refrigerants have gained increasing attention due to the global warming potential (GWP) of conventional hydrofluorocarbons (HFCs). Carbon dioxide (CO<sub>2</sub>) is a particularly attractive alternative to conventional refrigerants because it has relatively low GWP and no ozone depletion potential; it is nontoxic and nonflammable; and it has a high volumetric capacity. Unfortunately, the use of CO<sub>2</sub> transcritical cycles is greatly hindered by their inherently low efficiency and large discharge pressure relative to the HFC subcritical cycle.

Researchers at the University of Maryland have discovered a novel CO<sub>2</sub> transcritical vapor compression cycle refrigeration and heat pump system that will reduce the peak daytime demand for electricity. A thermal storage system is used to store the “coolness” at night and then to further “subcool” CO<sub>2</sub> exiting a gas cooler of a vapor compression refrigeration system during the warm day to follow. Subcooling the CO<sub>2</sub>—i.e., reducing the temperature of the refrigerant to below the ambient air temperature—before the expansion device can lead to an enhanced overall coefficient of performance and a reduced discharge pressure.

Applications:

- Residential and commercial air-conditioning systems

Advantages:

- Outperforms (in terms of efficiency) state of the art R410A refrigeration system
- Takes advantage of day and night temperature difference to boost efficiency
- Greatly reduces energy demand during peak hours in warm climates
- Subcooler consumes negligible electric power

## CONTACT INFO

UM Ventures  
0134 Lee Building  
7809 Regents Drive  
College Park, MD 20742  
Email: [umdtechtransfer@umd.edu](mailto:umdtechtransfer@umd.edu)  
Phone: (301) 405-3947 | Fax: (301) 314-9502

## Additional Information

### INSTITUTION

University of Maryland, College Park

### PATENT STATUS

Patent(s) pending

## **LICENSE STATUS**

Available for exclusive or non-exclusive license

## **CATEGORIES**

- Industrial Processing

## **EXTERNAL RESOURCES**

PS-2010-120