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_2) 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_2 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_2 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_2 exiting a gas cooler of a vapor compression refrigeration system during the warm day to follow. Subcooling the CO_2—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

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Additional Information

INSTITUTION

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PATENT STATUS

Patent(s) pending

LICENSE STATUS

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CATEGORIES

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EXTERNAL RESOURCES

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