Containerized High-Efficiency Cooling and Energy Management System

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ABSTRACT

Researchers at the University of California, Davis have developed a modular, containerized cooling solution designed to support high-density computing environments such as data centers and AI clusters. The system combines efficient air-to-liquid heat exchange, integrated energy storage options, and intelligent controls to reduce operating costs, improve deployment speed, and enhance system uptime.

FULL DESCRIPTION

This technology provides a prefabricated, transportable cooling module engineered to manage large heat loads efficiently while minimizing installation complexity. It uses advanced polymer-based heat exchanger components, embedded sensing, and automated reliability controls to maintain stable thermal conditions even under demanding operating scenarios. The system can incorporate optional thermal or electrical storage to reduce energy use during peak hours or power disruptions.

Built for factories or rapid-deployment data centers, the modular design allows operators to scale capacity, add redundancy, and integrate with existing infrastructure without needing specialized construction or customization.

APPLICATIONS

- High-density data center cooling (AI, HPC, cloud).
- Edge-computing and modular compute installations.
- Industrial facilities needing containerized thermal management.
- Carbon-management and sustainability-focused deployments.
- Backup cooling during grid outages or peak-load events.
- Retrofit cooling upgrades for existing IT infrastructure.

FEATURES/BENEFITS

- Factory-built, modular, rapidly deployable units.
- High-efficiency polymer heat exchangers for compact footprint.
- Automated fault detection and high-availability control logic.
- Optional thermal or battery storage for reliability and peak-shaving.
- Lower total cost of ownership than traditional cooling systems.
- Scalable architecture suitable for multi-megawatt expansions.

PATENT STATUS

Patent Pending

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OTHER INFORMATION

KEYWORDS

air-to-liquid heat exchanger, carbon-capture option, containerized infrastructure, data center cooling, energy-efficient cooling, high-density compute cooling, modular cooling pod, polymer heat exchanger, prefabricated cooling, thermal storage

CATEGORIZED AS

- **Energy**
  - Other
  - Storage/Battery
- **Environment**
  - Other
- **Engineering**
  - Engineering

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2025-589-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- A High Flux Microchannel Solar Receiver for Converting Solar Energy into Heat
- Predictive Controller that Optimizes Energy and Water Used to Cool Livestock
- High-Efficiency Heat Exchanger Operating at Elevated Temperatures and Pressures
- Microchannel Polymer Heat Exchanger

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