PRELIMINARY TECHNOLOGY ASSESSMENT – AUGUST 2024

Modular Ice Energy Storage

Technology Overview

The chiller systems typically used to cool large, commercial buildings place high demand on the electrical grid, accounting for around 14% of all electricity used commercially[1] and contributes to around 50% of building energy demand.[2] Modular ice energy storage is an innovative thermal energy storage (TES) system that brings more balance to the grid. By discharging and reducing loads at peak hours, the vendor estimates reduced peak-time cooling loads up to 95%.

Each storage cell contains 192 water capsules that freeze and thaw, storing and releasing thermal energy. The building is cooled as thermal energy is released. Modular ice energy storage systems charge during off-peak hours, or when there is a surplus of renewable energy, and discharge during times of high demand. The offset reduces pressure on the grid, lowers costs, and reduces GHG emissions. Modularity allows for design flexibility. Units can be stacked and placed in unused spaces, including in basements, layered flat on rooftops, or along walls and the perimeters of parking lots.

Why is GSA Interested?

Modular ice energy storage saves energy costs and GHG emissions and increases resiliency. It can be used to supplement an existing chiller system and to reduce backup generator loads during a power outage. Multiple systems can be networked together to operate as a virtual power plant based on signals from the grid.

Modular ice storage is safer than standard electrochemical-based storage systems, like lithium-ion, because it contains only water, plastic and aluminum, eliminating fire safety issues. They are non-corrosive, fully recyclable with no waste issues, and do not require mining nor space for large tanks of water, like traditional TES systems.

Deployment Potential

Any facility that uses a centralized chiller system can accommodate modular ice energy storage. A higher ROI is likely to be seen in warmer climates and they are especially useful in buildings where cooling needs are driven by load rather than external weather, like data centers or industrial applications.

Modular design allows for a variety of layout strategies, including integrating into landscape design for seating or other features. There are no safety concerns for use in highly populated locations.

[1] U.S. Energy Information Administration. https://www.eia.gov/tools/faqs/faq.php?id=1174&t=3#:~:text=EIA's%20Commercial%20Buildings%20Energy%20Consumption,cooled%20air%2through%20commercial%20buildings, accessed 08-2024.

[2] U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. "Thermal Energy Storage." https://www.energy.gov/eere/buildings/thermal-energy-storage#:~:text=Thermal%20end%20uses%20(e.g.%2C%20space,increase%20in%20the%20years%20ahead., accessed 08-2024.

Green Proving Ground (GPG), in collaboration with the U.S. Department of Energy, is evaluating the real-world performance of modular ice energy storage in federally owned buildings within GSA's inventory. The technology will be provided by Nostromo Energy and coordinated with other ongoing evaluations of this technology.

The GPG program enables GSA to make sound investment decisions in next generation building technologies based on their real world performance.