

Thermal batteries reduce peak load in a New York office building

NYSERDA NextGen Buildings Innovation Program

Introduction:

As a part of NYSERDA's NextGen Buildings Innovation program, Phase Change Material (PCM) heat batteries were installed in an office building in Latham, New York.

NYSERDA's NextGen Buildings Innovation program seeks to accelerate the development and commercialization of solutions that help electrify and decarbonize the building stock in New York State.

By supporting building innovations, the program enables buildings to be cleaner, more energy efficient, load flexible, and resilient.

The challenge:

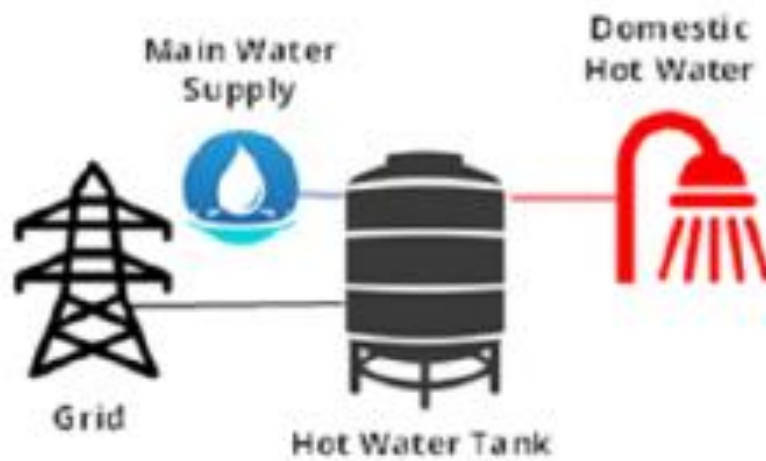
Under this program, PCM thermal batteries were installed in eight different sites, paired to several new and existing heating systems to sustainably and efficiently provide domestic hot water and heating.

The Latham office building has 114 workers, and the goal of this project is to compare the difference in efficiencies between the previous systems, which includes a 30-gallon electric tank water heater, and the electrically charged PCM thermal battery to deliver domestic hot water more sustainably.

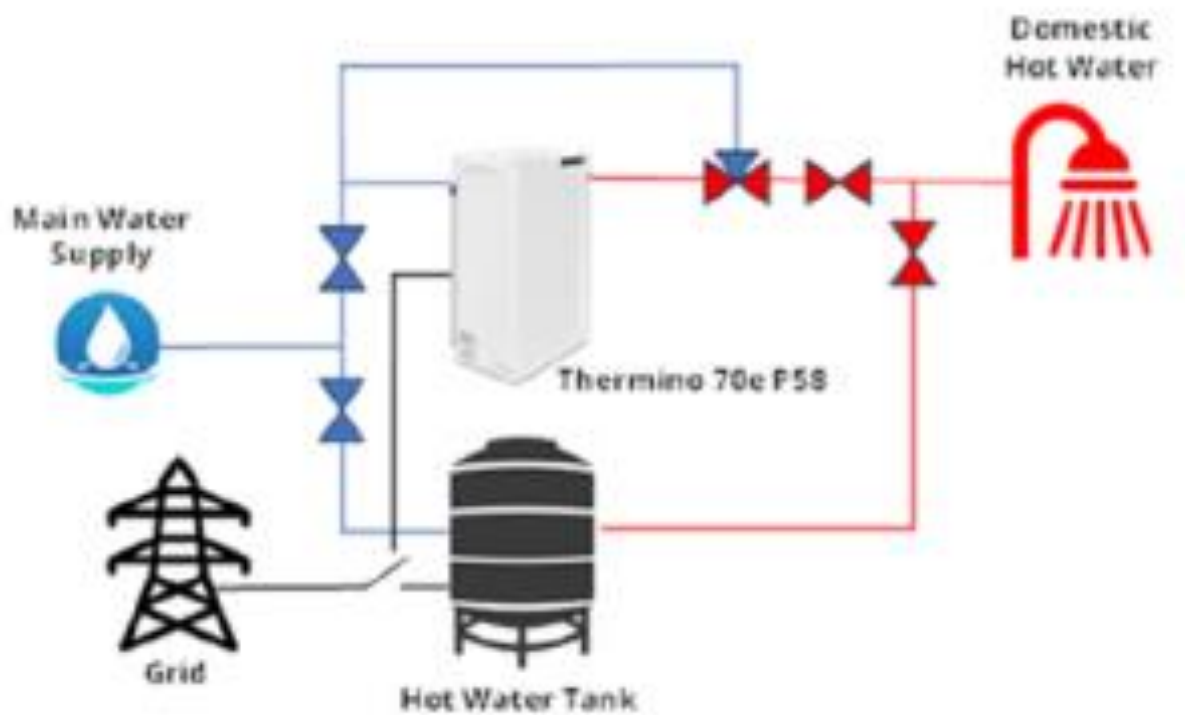


Case study site: Office building – Latham, NY

Existing System: Standard electric 30-gallon tank water heater



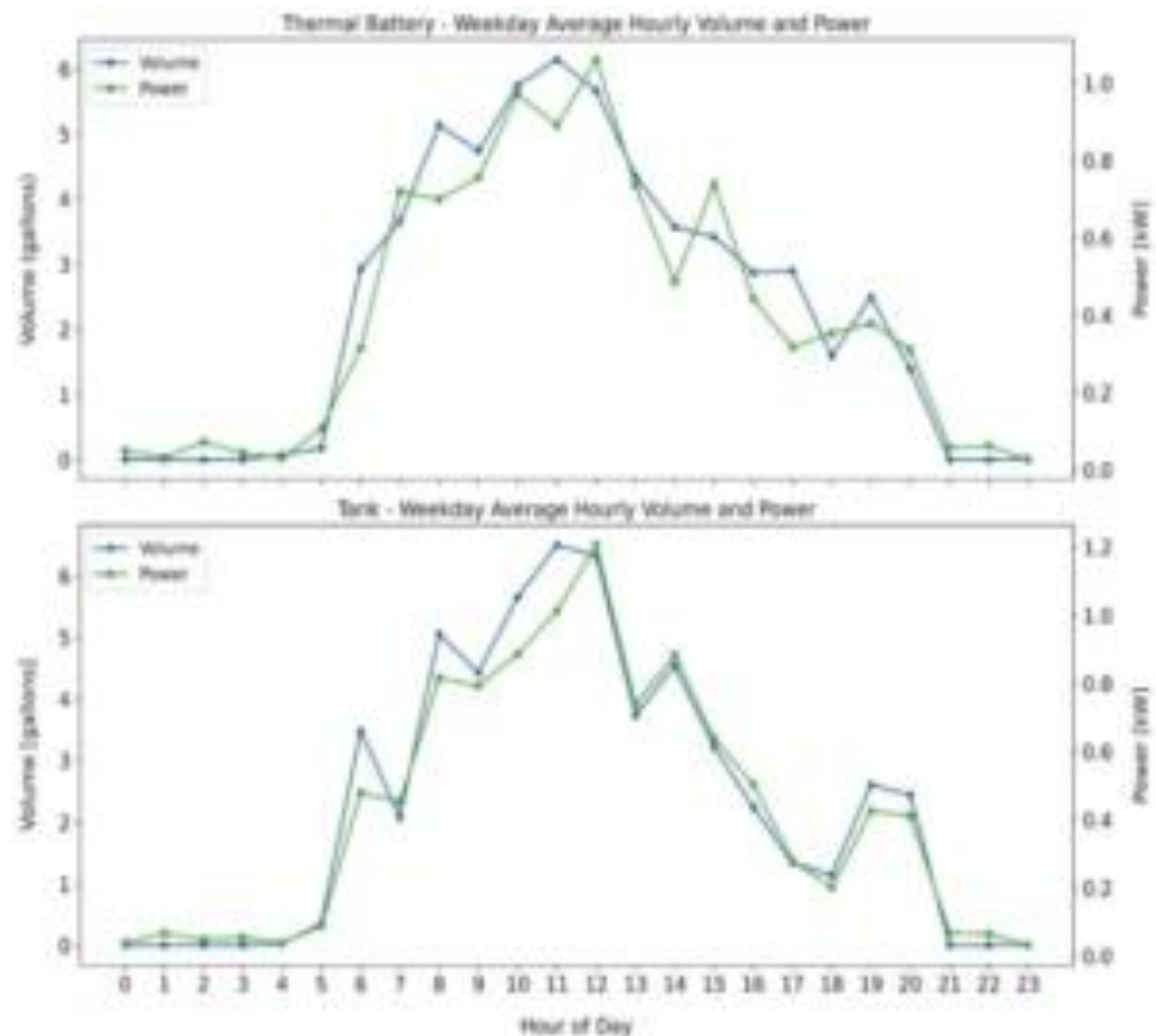
Proposed solution: PCM thermal battery electrically charged from the grid



The proposal:

A PCM thermal battery was installed in parallel to an existing electrically charged tank, offering a direct comparison in performance.

Monitoring and results:



Since peak hot water consumption occurred at midday, closely followed by peak energy consumption, there was an opportunity to leverage the PCM thermal battery to shift electricity demand to another time of day, which would benefit both energy costs and GHG emissions.

Based on the monitoring results, a timer was added to the thermal storage system, allowing it to charge during off-peak times.

The results were significant:

The PCM thermal battery drew a maximum current of 10.6 A – 29.25% lower than the maximum current of 15.2 A for the tank water heater, significantly cutting the load on the building's energy system.

The impact:

Charging the PCM thermal battery consumed an average of 7.42 kWh/day and 2.71 MWh annually, while the tank water heater consumed 7.55 kWh/day and 2.76 MWh/year.

The difference in the total GHG emissions between the two systems: 0.663 tons CO₂e/year for the PCM thermal battery and 0.675 tons CO₂e/year for the tank water heater.

However, the PCM thermal battery offered a remarkable benefit in terms of a 29% reduction in peak electrical load used by the water heating equipment, decreasing from 3107 W for the tank water heater to 2198 W for the PCM thermal battery.

This project showed the peak load reduction capability of a PCM thermal battery with an internal electric resistance heater compared to a typical electric hot water heating source.