



WHITEPAPER

# ENCLOSURE COOLING KEEPS ENERGY STORAGE SYSTEMS GOING AND GOING

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# Summary



Without integrated thermal management, batteries and other energy storage system components may overheat and eventually malfunction. This whitepaper explains how enclosure cooling can improve the energy storage capacities and reliability of today's advanced energy storage systems.

## Introduction

Renewable energy systems have been around for several decades now. Popular for their low environmental impact and economic benefits, these systems use replenishable carbon-neutral sources like sunlight and wind to augment power from utility grids. While renewable energy systems provide an eco-friendly alternative to fossil fuels, they have historically posed some challenges such as on-demand availability and intermittency. In most cases, relying on renewable energy as a power source had been limited to real-time use in favorable weather conditions; if the sun wasn't shining or the wind wasn't blowing, then solar or wind-powered energy systems were ineffective.



## A Bright Future



Advancements in energy storage technology have had a significant impact on the renewable energy industry. The use of rechargeable lithium-ion battery systems is increasing, and intelligent battery software now enables excess energy to be saved and used when needed. These recent improvements in battery energy storage systems (BESS) offer several advantages, including the ability for load shifting, peak shaving and emergency backup systems. Load shifting and peak utility electric power shaving dramatically reduce the rate charge per kilowatt, providing an early payback and long-term reduction of electric bills. Additionally, large solar arrays producing excess power sent into the grid may result in charges billed to the end user, but this can be avoided when excess energy is stored and dispensed when advantageous rather than metered to the grid. A quick transition to emergency backup power is facilitated with the energy stored in the battery systems without the delay caused by waiting for a backup generator to power up.

The benefits offered by the latest energy storage technology have helped customers by supplementing electricity from the utility companies and limiting the percentage of power used during peak hours. More recently, this technology also allows for greater storage capacities in smaller sizes, making commercial applications more feasible as the smaller footprint minimizes the need for available real estate. As a result of these advancements, in many cases, energy storage systems can now be delivered and easily installed onsite, as a turnkey solution.



# The Need For Thermal Management

As with most electronic devices, operation within hot and cold temperatures often results in reduced power and longevity. Specifically, the charging and discharging of a battery storage system creates heat which needs to be managed to maximize reliability and efficiency. Outdoor installations will be exposed to inclement weather and extreme temperatures, including solar loads on the electrical enclosures housing the batteries or associated equipment. Without specialized thermal management, energy storage capacities will be reduced, as systems may overheat and eventually malfunction.

Active cooling and heating should be introduced to these enclosures to maintain an ideal temperature range for the equipment inside. [Closed-loop enclosure air conditioners](#) are an optimal way to remove excess heat while keeping a battery compartment clean and isolated from the outside ambient air. With an integrated thermal management solution from Kooltronic, the lifespan of renewable energy storage systems will be extended, and the efficiency and reliability of the electronic components used to monitor and control them will be enhanced.



## Thermal Management Solutions

Maintaining an ideal temperature range is critical to the performance of battery energy storage systems. [Closed-loop cooling](#) units keep battery compartments cool, clean, and dry to ensure efficient, long-lasting operation. Kooltronic offers a large inventory of enclosure cooling solutions suitable for indoor and outdoor use. Simple to install, Kooltronic products are available in various BTU capacities and voltages, and units can be custom painted to match a compartment or enclosure. Specialized thermal management products for battery energy storage systems are also available.



Explore BESS Cooling Solutions at  
[kooltronic.com/bess-cooling](https://kooltronic.com/bess-cooling)



# Air Conditioners



## ► Features

Closed-loop air conditioners cool, dehumidify, and recirculate clean air within an enclosure. AC units can also add supplemental heat in cool ambient conditions.

## ► Benefits

- Clean, effective cooling.
- Maximizes battery efficiency.
- Extends life of system components.

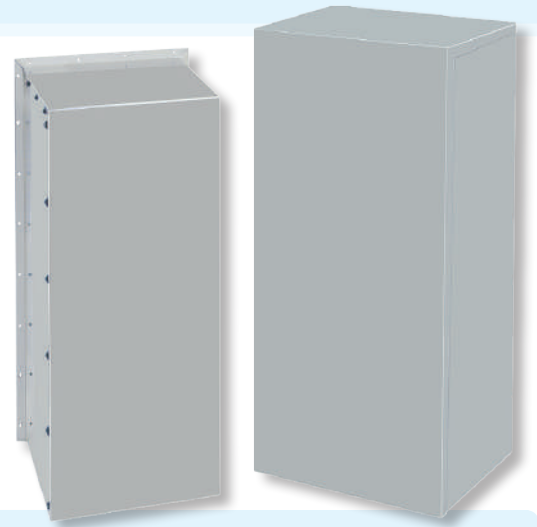
# Heat Exchangers

## ► Features

Water-to-Air Heat Exchangers provide uniform cooling where a reliable source of clean, cool water is available. A closed-loop system ensures ambient air is sealed out while heat transfer surfaces remain clean.

## ► Benefits

- Clean, effective cooling.
- Improves efficiency and reliability of electronic components.



# Heaters



## ► Features

Compact, high-performance fan heaters prevent the formation of condensation and provide an evenly distributed interior air temperature in outdoor enclosures.

## ► Benefits

- Compact, high-performance heating.
- Designed to prevent condensation.



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