These buildings use batteries made of ice to stay cool and save money

Ice batteries help office towers, warehouses and stores shrink their power bills and carbon footprint. Soon, they're coming to houses.

March 1, 2025 at 6:00 a.m. ESTToday at 6:00 a.m. EST

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By Nicolás Rivero

Thousands of buildings across the United States are staying cool with the help of cutting-edge batteries made from one of the world's simplest materials: ice.

When electricity is cheap, the batteries freeze water. When energy costs go up, building managers turn off their pricey chillers and use the ice to keep things cool.

10 steps you can take to lower your carbon footprint

A typical building uses about a fifth of its electricity for cooling, according to the International Energy Agency. By shifting their energy use to cheaper times of day, the biggest buildings can save hundreds of thousands of dollars a year on their power bills. They can also avoid using electricity from the dirtiest fossil fuel plants.

In places where the weather is hot and energy prices swing widely throughout the day — for instance, Texas, Southern California and most of the American Southwest — buildings could cut their power bills and carbon emissions by as much as a third, experts say.

"That's huge and absolutely worth doing when you consider how many buildings exist that need cooling," said Neera Jain, an associate professor of mechanical engineering at Purdue University.

So far, ice batteries have been mostly limited to big commercial buildings with central cooling systems and extra storage space for a giant vat of ice. But new designs could bring the batteries into smaller buildings and even houses.

Reviving an ancient cooling technology

Ice batteries are a high-tech return to one of the most ancient forms of air conditioning and refrigeration in human history.

People have been making or harvesting ice and storing it to cool food, drinks and buildings for thousands of years. Fast ships turned the ice trade into a global industry in the 19th century, when ice from America's frozen lakes became the second-largest U.S. export behind cotton.

But over the past century, ice stockpiles have given way to mechanical air conditioners and refrigerators, which use a tenth of the world's electricity. Most big buildings now have chillers, energy-gobbling machines that cool water and then pump it throughout the building to bring the temperature down.

Ice batteries take some of that cooling power and save it for later. When energy is cheap, the battery makes ice — like a giant version of the ice machine you might find in your freezer or a hotel hallway. When electricity prices rise, the building shuts off its chiller and instead uses the ice to cool the water that's circulating through the building.

The batteries shift the times when buildings use energy, which helps them save money and eases the burden on the power grid. When every building is blasting its air conditioner at the same moment on a hot day, power companies often fire up backup generators, known as peaker plants, which are generally extra pricey and polluting.

If utilities avoid using peaker plants, they'll pollute less and save money. Last year, the Energy Department struck a tentative $306 million loan deal with the ice-battery-maker Nostromo Energy to install its systems in 193 California buildings to make energy cheaper and cleaner while lowering the state's blackout risk.

"If we can save costs for the utility, that means consumer rates are going to go down and we make power more affordable," said Nostromo Energy CEO Yoram Ashery.

The fate of the Nostromo Energy project is uncertain after the Trump administration froze nearly all Energy Department loans.

An ice age for batteries

So far, ice batteries have mostly been limited to office towers, hospitals, hotels and other large buildings with central air conditioning because the batteries themselves are huge. One system built in the basement of a New York City banking tower involves 100 tanks, each the size of a parking spot, which collectively make 3 million margaritas' worth of ice each night, according to Holly Paeper, president of the Americas commercial HVAC division of Trane Technologies, a company that has installed ice batteries in 4,000 buildings across 60 countries.

But that's starting to change. Nostromo Energy designed its skinny "Ice Brick" batteries to fit into tighter spaces. California-based Ice Energy has installed thousands of its Ice Bear batteries on one-story stores and plans to start offering a smaller version, dubbed the Ice Cub, to homeowners later this year.

Wherever they can squeeze into the market, ice batteries could be a cheaper and longer-lasting option than the lithium-ion batteries that power phones, cars and some buildings because their main ingredient is water, experts say. The pricey chemicals in a lithium-ion cell might degrade after 10 years, but water never wears out.

"In theory, you should be able to freeze and thaw something forever," said Allison Mahvi, an assistant professor of mechanical engineering at the University of Wisconsin at Madison. The only practical limit is the lifespan of the batteries' pumps, valves and heat exchangers, which can last for decades.

Ice battery companies claim their products cost about half as much as lithium-ion cells over the course of their long lives. The downside: Ice batteries work only for cooling. They don't store energy for anything else that uses electricity in a building.

"You're never going to turn a lightbulb on with stored ice," said Joe Raasch, chief operating officer at Ice Energy. "But air conditioning is typically the highest [energy] consumer for buildings."

The main limits on the technology's growth are the local climate and power grid. Buildings in cold places may not run their air conditioners often enough to justify buying an ice battery. And if power companies don't change their prices throughout the day — or pay their customers to use less electricity at certain hours — then ice batteries won't save buildings any money.

But in the places where they make sense, ice batteries can combine with other forms of energy storage to help the power grid keep up with rising demand for electricity while relying more on wind and solar power that rise and fall with the weather.

“Someday, I hope that we can integrate it more into different types of buildings, so you’ll see it on your apartment, or you’ll see it in your house,” Mahvi said. “Aggregating all that together can make a huge impact on the ability to use renewable energy.”