



# Ice-Enhanced Air-Cooled Chiller Plant

An EarthWise™ System from Trane



# More economy, more sustainability, more cooling capacity



## **A system that makes both economic and environmental sense.**

Trane® EarthWise™ systems are a carefully curated set of systems that are good for building owners and better for the environment. They typically save 20 to 30 percent over competing alternatives. One of the EarthWise systems, the ice-enhanced air-cooled chiller plant, can improve building owners' bottom lines by shifting cooling to less-expensive offpeak hours. The system also reduces a building's environmental impact by shifting cooling to off-peak hours, when the power comes from a higher mix of renewable and cleaner sources, including wind energy and natural gas-powered electrical plants. By reducing the load on the power grid during peak hours, dirtier, less-efficient power equipment is unloaded and the pace of new power plant construction can be slowed. The system also consumes no water — a benefit in many areas where water shortages are an acute or growing problem.

A building's need for reliable cooling must be met. But ever-increasing burdens on electric utilities mean ever-increasing prices for peak-demand power. Many building owners want to participate in utility energy demand management programs, but utilities ask that equipment be turned off precisely when buildings need cooling the most. A thermal energy storage system gives owners and tenants flexibility without compromising business operation, at a lower price than competing energy storage options. Ice-enhanced chiller systems are proven, effective cooling solutions that can also reduce equipment first costs, provide supplemental and backup cooling capacity, and earn LEED® credits.

## **A proven solution for economical, dependable cooling**

The Trane® EarthWise™ ice-enhanced air-cooled chiller plant uses one or more chillers in a system that operates at night to create cooling when utility rates are lower. That cooling is stored in specially designed ice tanks. During the day, the ice is melted to cool the building, for significant savings on utility bills. To help pay for the system, rebates and other monetary incentives are available from participating entities such as utility companies and state governments.

Trane and the CALMAC manufacturing corporation have been reliably cooling buildings and processes with ice for more than 25 years, using both proven technology and the latest innovations to deliver economical, dependable cooling performance. CALMAC innovations include the elimination of mechanical fittings in ice tanks, for even longer system life with virtually no maintenance. Chillers have come a long way too in those 25 years. Today's chillers are very quiet, with variable-speed technology on the fans that's now available on the compressors too. The Trane-built system completion module makes systems come together quickly and painlessly, and with repeatable success on every project.

### Trane air-cooled chiller

Air-cooled chillers are ideal for making ice, because they experience a big efficiency improvement at night. Trane offers a wide variety of chiller configurations, including many that lead the industry in part-load and full-load efficiencies. Low sound levels throughout the portfolio mean the system is less likely to disturb building occupants or neighbors.

### CALMAC IceBank thermal energy storage tanks

The cold brine produced by the chiller freezes water stored in durable, insulated tanks engineered and produced by CALMAC, a recognized leader in thermal storage solutions. CALMAC's factory-built tanks have cataloged performance and no surprises. The brine flows through thermally welded headers and tubes, which have no mechanical fittings and require virtually zero maintenance.

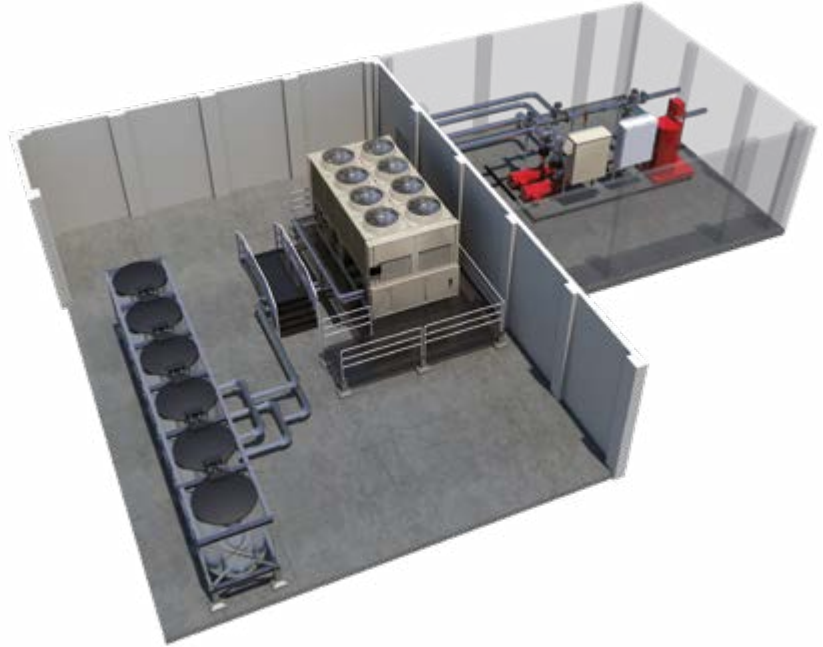
### Trane system completion module

Built, tested and backed by Trane, the system completion module coordinates chiller operation, ice storage and deployment, glycol management and hydronic specialties: air separation and venting, fluid expansion and straining, isolation and service valves. It includes pre-engineered, variable-speed pumping, single-point power and control connection, sensors, automated valves, and factory-installed Trane component and system controls. Repeatable designs lead to repeatable performance, in a Trane system with one number to call for help.

### Reduces energy, maintenance and water costs

A Trane ice-enhanced chiller system delivers low-cost operations and improved performance to your building.

- **Lower energy costs** — Cooling demand peaks and power demand peaks are virtually simultaneous — it's the demand for cooling that drives the demand for electricity in almost all commercial buildings. Roughly half of a building's electrical bill can be traced to peak electricity use, whether the rate appears that way or not. When peak charges are spread over all hours of operation, there's a 50 percent off or better sale on electricity every night. Moving some or all of the peak cooling to off-peak periods reduces electrical bills significantly. The superior CALMAC® IceBank®



tank design means that the chiller operates at higher supply temperatures during the freezing process than competing designs. This in turn makes the chiller more efficient throughout the ice-building cycle.

- **Lower maintenance requirements** — Trane chillers create ice in CALMAC IceBank thermal energy tanks. Their durable, thermally welded polyethylene heat exchanger and seamless plastic tank contain no moving parts and are virtually maintenance-free. Trane ice-enhanced aircooled chiller plants deliver water-cooled or better system performance without cooling towers. This means they are free of cooling tower maintenance: regular cleaning of the tower and chiller condenser tubes, treating the water and winterization or freeze protection. Fewer, smaller chillers working with ice tanks cost less to maintain while providing similar redundancy.
- **Lower water costs** — Air-cooled chillers reduce water costs by eliminating cooling towers, which lose a significant amount of water through evaporation and drift — water that must be replaced. In addition, the water that evaporates leaves behind dissolved minerals, at a rising concentration level, in the water that remains in the tower. Water must be periodically drained out and replaced with clean water in a process called blowdown. Cooling tower water use is usually about one-tenth of the cost to operate a water-cooled system.

# One cooling solution. Multiple benefits



## Utility incentives for now and later

In addition to ongoing energy cost savings, energy storage and load-shifting systems are also eligible for monetary incentives from utility providers, government jurisdictions and grant programs. Some are focused on offsetting the first cost of the system, while others are ongoing throughout the life of the system.

- Some utility programs provide monetary compensation per shifted ton of cooling or shifted kW. These are one-time payments that help pay for the system.
- Other utility programs are designed so that a building deploys energy storage at times of shortage and consider that building to be a virtual power producer, providing reserve capacity within the utility's system. The utility pays the building's owner for the offset power, creating business revenue and shortening the payback period.
- Curtailment rates and other voluntary rate structures can be negotiated to reduce the cost of all power a building uses. A building with thermal storage may continue operations unhindered by their utility's requirement to use less power when directed.

The Trane® EarthWise™ ice-enhanced air-cooled chiller plant can provide benefits that extend far beyond reduced utility costs — and environmental advantages that extend far beyond the building it serves.

## Increased cooling capacity range; competitive first cost

A properly designed cooling system is sized to handle peak and minimum cooling loads. Many designers choose to install excess capacity and redundant equipment. Besides higher initial cost, a rarely used redundant chiller has an ongoing cost: It must be maintained to be available when needed. Oversized equipment is not a good idea either: The efficiency is lower and the system may not operate properly, especially at low-load conditions. An ice-enhanced system provides reserve cooling capacity and redundancy, plus superior lowload turndown — all at a competitive first cost, without idle equipment to maintain.



### **Cooling during electrical reduction or interruption**

Electrical service reductions and interruptions can be caused by periods of high demand, storms and unforeseen events. Additionally, some utility companies offer monetary incentives to customers who voluntarily participate in service reductions during periods of high demand.

A Trane ice-enhanced cooling system can use its stored energy to meet cooling loads even during periods of limited electrical service, while keeping the chiller off. This benefit can also reduce the size and cost of emergency power generation systems.

### **Overcoming constraints to system expansion**

Trane ice-enhanced cooling systems offer benefits both now and in the future. When systems are out of capacity, it's often just for a few hours, on a few memorable days per year. Adding thermal energy storage tanks can be a much lower-cost option when compared to adding one or more chillers, and additional tanks typically don't require more capacity in the power components: transformers, generators, wiring, circuit breakers. The package is designed to integrate with your existing chilled-water system.

#### **Environmental stewardship: Your cooling system plays a role**

Trane ice-enhanced cooling systems not only use less expensive electricity, they also use less of it, in a more environmentally sustainable manner. In fact, ice storage systems are specifically identified by the U.S. Green Building Council as eligible for LEED® innovation in design credits. Here's why:

- The chiller produces ice at night, when outdoor air temperatures are lower — which increases the chiller's efficiency and capacity.
- Compared to electricity generated during the day, a larger percentage of the electricity produced at night comes from sustainable sources, including wind energy and more efficient, base-loaded power plants. Like the chiller, power plant combustion turbines experience both efficiency and capacity improvements when temperatures are cooler.

- Lower peak electrical loads reduce the need for construction of new power plants and ease the peak load bottleneck in power-constrained areas.
- The ice-enhanced air-cooled chiller plant improves on a water-cooled system's energy performance while consuming no water for heat rejection.
- Energy costs reflect the overall cost of creating and delivering energy — including items such as power plant water use, site physical disruption and other environmental factors. Buildings using ice storage systems reduce energy costs and also reduce these other indirect impacts on the environment. This is why ice storage systems are strategies recognized by LEED, Green Globes, and advanced building codes like ASHRAE Standard 189.1 and Title 24 in California.

# Feel the Trane difference

Ice-enhanced cooling systems are available from other HVAC manufacturers, but Trane offers key benefits that deliver distinct advantages in system performance, efficiency and reliability.

## Proven, single-source design for lower risk

Unlike a custom design, the Trane® EarthWise™ ice-enhanced air-cooled chiller plant offers a pre-engineered, proven sequence and setup. Decades of ice-storage application experience are your assurance that a Trane ice-enhanced cooling system will deliver optimal, repeatable performance. And because the Trane system is a single-source solution, there's only one number to call for assistance or questions.

## Pre-packaged programming and dashboards

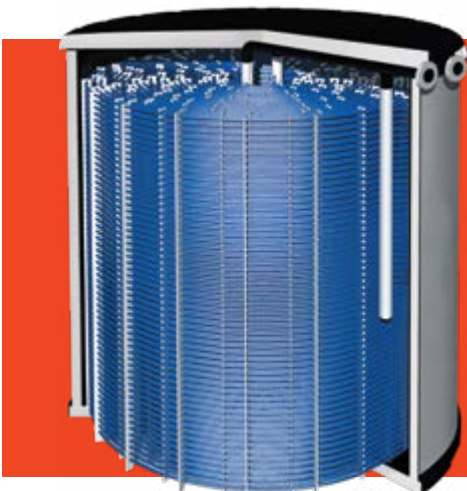
The system package includes dashboards that coordinate seamlessly with the underlying controls and sequences of operation. When an adjustment is needed, the technician isn't manually adjusting the programming; configuration screens are included. Other users such as plant operators, facility managers, system engineers, optimizers and occupants can interact with the system in an access-controlled manner.

- Trends show the operation over time
- Gauges show the current operation
- System schematics display the components' status, setpoints and measured values
- Cost summaries estimate the amount saved by the system
- Strategic data informs the operator how the system is working

## The Trane EarthWise system solution

Only Trane offers the EarthWise system solution: the pairing of a Trane air-cooled chiller with Trane controls optimized to meet the objectives of the system. The result is exceptional operating cost savings under all conditions. As with all EarthWise systems, energy costs can be 20 to 30 percent lower than alternative systems using non-Trane chillers or controls.

Trane EarthWise systems use tested, proven efficiency improvement strategies that yield documented, repeatable results — giving you confidence that your system will deliver high performance as expected.



## Superior CALMAC IceBank design

Trane ice-enhanced chiller plants circulate brine through tubes inside the IceBank® tanks to freeze water that's held in the tanks. The tank heat exchanger is so efficient and uniform at building ice that the chiller operates at higher supply temperatures during the freezing process than competing designs. This in turn makes the chiller more efficient throughout the ice-building cycle. The CALMAC® design is modular, factory-built and -tested, with cataloged performance that leads to no surprises.

# Trane solutions: Making buildings better for life



## **Performance.**

Trane products are designed, engineered, built and tested to be solid performers, quietly doing their jobs year after year with minimal need for maintenance and repairs. The Trane EarthWise ice-enhanced air-cooled chiller plant builds on a long history of efficient, durable HVAC products that deliver the performance our customers expect and deserve.

## **Innovation**

Founded a century ago on the belief that imagination and inspiration can overcome any obstacle, the Trane legacy of innovation has made it an industry legend. Today's Trane ice-enhanced cooling systems continue that legacy by providing innovative solutions to the specific HVAC needs of a large segment of our customers.

## **Commitment**

Rising utility costs impact our customers — and therefore impact Trane. Our ice-enhanced chiller plants were conceived to address this issue and affirm our commitment to serving the needs of our customers.

## **Knowledge**

To become and remain an industry leader requires a full understanding of existing knowledge and a never-ending quest for new discoveries. For over a century, Trane has built and maintained its leadership status in the HVAC industry by employing the brightest and most inquisitive scientists, engineers and design experts — all of whom share a singular passion to know, explore and share the ever-evolving technology that improves the lives of our customers.



Visit [Trane.com/ice](https://www.trane.com/ice) for more information on the Trane EarthWise ice-enhanced air-cooled chiller plant — or contact your local Trane account manager to learn more.

Learn more at [trane.com](https://trane.com)



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