

# Thermal Ice Storage



Thermal ice storage provides many environment-friendly opportunities that are a result of reduced peak electrical demand. This is just the tip of the iceberg, below the surface the opportunities are much larger...



Thermal Ice Storage reduces the risks of unrestrainable energy costs, uncertain conventional energy supplies and unreliable renewable power sources. Thermal Ice Storage provides a proven, fiscally responsible energy storage solution.

## General description



Thermal storage systems have been in existence for many years. Although many early applications involved systems installed in dairies, churches, and theaters, most current applications are used for continuous comfort cooling. The purpose of a thermal storage system is to create thermal energy and store it for use at another time.

There are several types of thermal storage systems in use today. These systems can be either the full or partial storage type.

In the typical full thermal storage system, the refrigeration system (chillers) generates ice at night when electrical utility rates are typically lowest (off-peak). During the day, when utility rates are higher (on-peak), the ice is then melted to provide cooling to the building.



## Benefits

- Ice storage shifts the cooling load to off peak demand times, reducing peak loads thus allowing the utility to serve more customers without having to add additional generating capacity.
- Ice storage shifts power demand to low cost periods.
- Reduce energy costs by shifting peak power demand to night time or off-peak periods. Avoid on-peak time-of-use rates and high ratchet-based demand charges - off peak electricity rates 50% to 80% lower! This huge energy cost saving provides short payback periods for ice storage installations.
- Demand response programs incentivise consumers to curtail electricity use during peak demand periods to receive substantial rebates. Most peak electricity used is for air conditioning. Thermal ice storage is the ideal strategy for commercial buildings to comply with demand response & still provide cooling to office space. Demand response is a sustainable technology, reduces carbon emissions & improves grid reliability. A smart grid combines technologies including smart meters, real time pricing, energy control, electric vehicle integration & energy storage.
- Ice storage tanks are up to 8 times SMALLER than chilled water storage tanks for the same thermal capacity.
- Thermal Ice storage can reduce the size and cost of chillers, cooling towers and electrical switch gear by 40% to 50%.

In the partial thermal storage system, a reduced size chiller or refrigeration system operates in conjunction with the ice storage to meet the peak loads.

There are several types of partial storage systems whose application is dependent on building loads, system equipment and energy costs. However, many partial storage systems are used to “shave off” peak energy demands to reduce operating costs.

The product technology that EVAPCO provides for the thermal storage industry is referred to as “ice on coils”.

In this type of system, cylinders of ice are built onto the tubes of hot dipped galvanized steel coils.

In most systems that use this technology, multiple banks of coils are submerged under water in field constructed concrete tanks.



## Where can it be used?

### New Installations

- District cooling
- Universities
- Corporate campuses
- Airports
- Large central cooling plants
- Hospitals
- Convention centres
- Sports arenas
- Office buildings

### Replacements & Retrofit

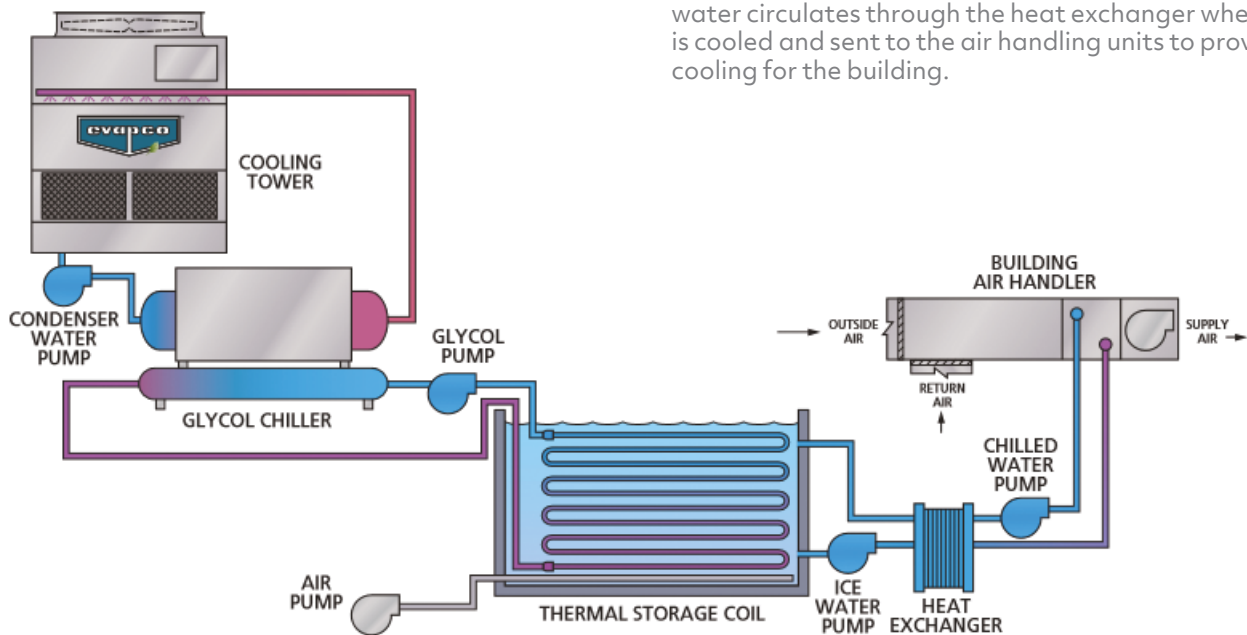
- Chiller replacement
- Add cooling capacity without increasing: Building transformer, Switch gear, Motor control centre
- Solve existing building temperature and humidity problems by: Lowering chilled water supply temperature, Lowering air supply temperature

## Sequence of operation

Thermal storage systems use either glycol chillers or direct refrigeration systems to provide the cooling necessary to generate the ice on the tubes of the coils. However, the most common system used for comfort cooling applications utilize glycol chillers, as is shown in the schematic below.

The air conditioning system that incorporates thermal storage has major components consisting of chillers, cooling towers, heat exchangers, pumps, thermal storage coils, and the building air handling equipment.

The FULL thermal storage system has two modes of operation; ice build and melt-out.



**Thermal Storage System Schematic**

## Full build operation



### Ice build

During the off-peak period, the glycol chiller is operational. The glycol chilling system is generating low temperature glycol that circulates through the tubes of the thermal storage coils. The circulating glycol removes heat from the water in the tanks which causes this water to freeze onto the exterior surface of the thermal storage coils.

### Melt-out

During the melt-out phase, the refrigeration system is off. Depending on the melt-out type, either glycol is circulated through the tubes of the coils or the tank water is circulated over the coils to extract the energy from the ice. This cold glycol or ice water is then circulated through the primary side of a heat exchanger. Simultaneously, the building's chilled water circulates through the heat exchanger where it is cooled and sent to the air handling units to provide cooling for the building.

## Ice Pak™ storage units - design & construction features

### High density insulation

- Fully isolates tank from structure - no cold bridges
- R - 19.5 sides
- R - 13 bottom & top

### Heavy duty steel coil

- Exclusive EXTRA\_PAK® coil technology
- ASME B31.5 design & construction
- 300psig working pressure
- Hot-dip galvanised after fabrication
- Connections grooved for mechanical coupling

### Removable access cover

- Large size - 20" x 34"
- Easily handled - 15lbs
- Fully insulated

### Heavy duty construction

- Corrosion resistant stainless steel tank, welded water-tight
- G235 Hot-dip galvanised steel structural supports
- G235 hot-dip galvanised steel panels protect insulation



### Inventory measurement & control

- Clear sight tube for viewing water level
- Electronic controller with 4-20mA output signal
- Mechanical relays for ice charge termination & low level alarm



# Other products & services



[windsor.sales@windsor.co.nz](mailto:windsor.sales@windsor.co.nz)

Windsor Engineering Group provides full-life service and maintenance support to customers throughout New Zealand.

Our dedicated service team provides installation, commissioning, routine maintenance, emergency cover and engineered upgrade work for all industrial applications and works with customers from all industry sectors.

Other products & services offered include:

## Air filtration

- Chemical gas & odour filtration
- Filter media
- Frames, housings & accessories
- HEPA filters
- Hospital & clean room equipment
- Panel filters
- Pocket filters
- Servicing & parts

## Coils

- Air handling units
- Boiler heat recovery units
- Direct expansion coils
- Finned tube
- Laundry coils
- Special coils
- Stainless steel water coils
- Steam coils
- Thermal fluid coils & tube bundles
- Unit heaters
- Water coils

## Cooling towers

- Packaged cooling towers
- Site erected cooling towers
- Servicing & parts

## Energy

- Air Heaters
- Biomass conversions
- Boilers
- Servicing & parts

## Expanded metals

- Animal cages, benches, bird proofing, building cladding
- Car grilles, ceiling panels, correctional facilities & transport
- Decorative panels, display stands
- Filters, fire screens, flooring, gratings, grilles
- Machinery guarding, non-slip surfaces, plant supports
- Racks, screens for anti-glare, privacy, sun & ventilation
- Shelving, security mesh, street furniture
- Strengthening and reinforcing material for concrete & plastic products, trays, ventilation

## Heat exchangers

## Industrial fans & blowers

- Blowers
- Clean air fans
- Material handling fans
- MVR fans
- Packaged blowers
- Specialised fans

## Material handling equipment

- Pneumatic transfer
- Rotary valves
- Silos

## Noise control

- Acoustic enclosures & louvres
- Attenuators
- Specialised attenuation



**Please contact our Auckland sales office for these products:**

Unit 1, 23 Druces Rd, Manukau, Auckland 2104, New Zealand

Ph: +64 9 262 4474

[auckland.sales@windsor.co.nz](mailto:auckland.sales@windsor.co.nz)