



# The Rise of **ICE STORAGE TANKS** in HVAC Systems

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**E**very building manager is constantly searching for ways to reduce operating costs while also keeping their buildings “green.” One of the areas where they can greatly reduce costs is in their building’s heating and cooling systems. One cost-reducing concept that has been gaining popularity is the use of ice storage tanks in cooling systems.

Simply put, an ice storage system makes ice to decrease the cost of cooling a building. A typical ice tank system usually consists of a glycol loop connecting a designated ice-making chiller or built-up refrigeration system with the ice storage tanks, a heat exchanger, piping and pumps.

Ice tank storage systems have two modes: the ice charging mode and ice melt/burn mode. During the ice charging mode, the designated chiller is used to create low-temperature glycol, which is pumped through the tanks, freezing the water in the ice storage tanks. The ice charging mode is usually around 8-10 hours and it happens during off-peak hours. The ice melt starts during on-peak hours when the building load requires cooling.

The most common type of ice storage is “internal melt ice-on-coil.” In this process, ice is formed on the submerged pipes by circulating the low-temperature glycol through the pipes inside the tank. The ice melt process begins when the temperature of the glycol in the pipes increases – due to an increased building load – melting the ice from the inside. Other types of

ice storage include external melt ice-on-coil, ice harvesting, encapsulated ice and ice slurry.

There are two approaches for ice storage: full storage and partial storage. Full storage is when the whole on-peak cooling load is done during off-peak hours. During this process, the chiller runs at full capacity to be able to fully charge the tanks. Then, during on-peak times the cooling loads are met by the storage tanks and the chiller does not run. This process requires a larger chiller and increased storage tanks. In the partial storage process, a smaller chiller is used. It also uses off-peak times to charge the tanks. However, this off-peak charging is not enough to meet the cooling load, so during on-peak times both the chiller and the storage tanks are used to meet the building’s cooling load.

The cost savings in ice tank systems come from shifting the ice charging mode to off-peak nighttime hours – when energy costs are usually lower – and avoiding high-demand charges. The ice also increases the length of the “free” cooling cycle which decreases the load on the chillers. Capital costs are usually higher for an ice tank system, however, due to the reduced energy costs, the system can make economic sense. Capital costs can sometimes be lowered because, depending on the type of ice tank storage being used, the chiller can be smaller than one required for direct cooling which translates to smaller cooling tower fans, smaller condenser fans and smaller condenser pumps. ●