Colorado Springs Utilities
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White Paper #19

Evaporative Pre-Cooling of Large Air-Cooled HVAC Equipment

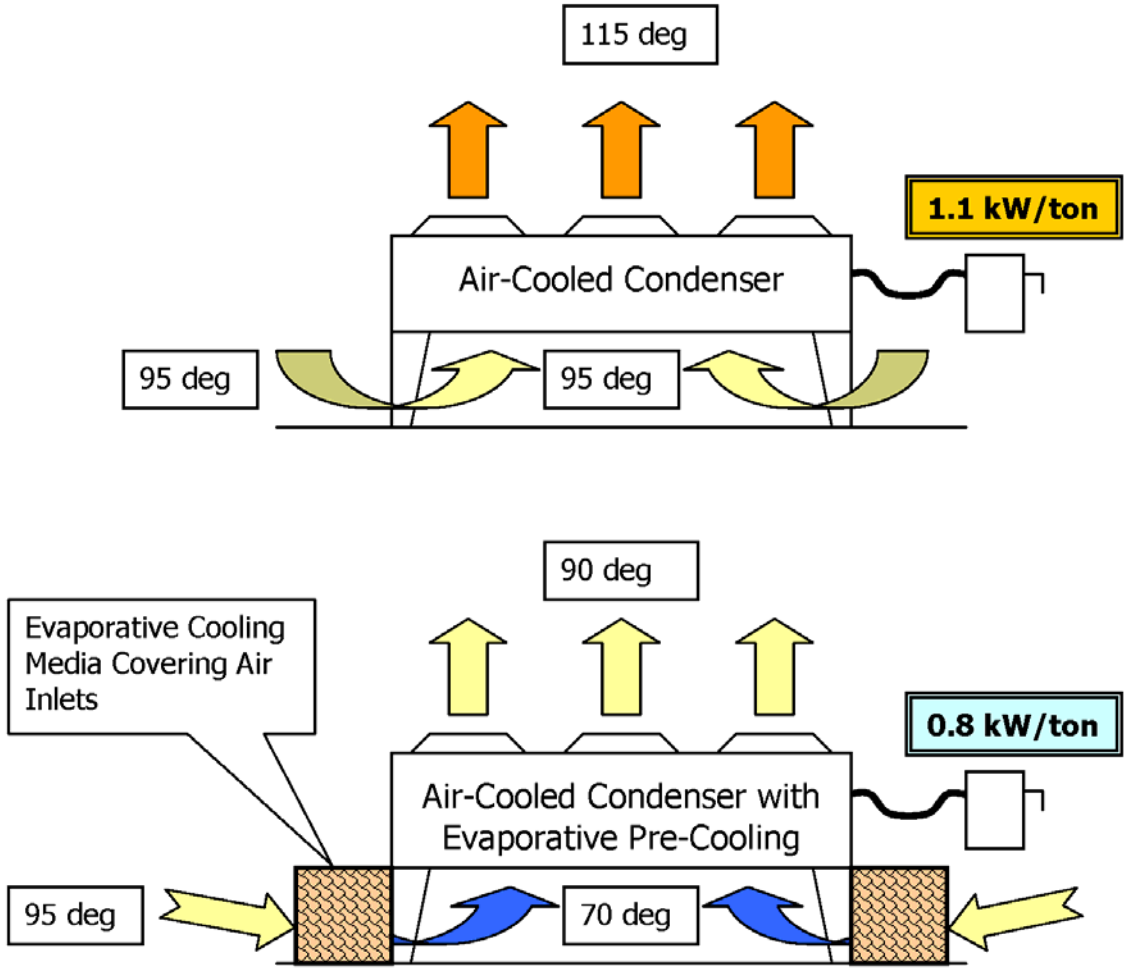
Even when it's 95 degrees outside, your equipment will 'think' it's only 70 degrees.

The energy used by an air-cooled HVAC unit varies directly as the outside air temperature. The hotter it is outside, the harder the equipment works and the more energy it uses. The rule of thumb for this type of equipment is 1 to 1.5 percent of electrical demand and energy reduction for each degree F reduction. So, it's a safe bet that your air conditioning equipment will use 25 percent less energy at 70 degrees than it does at 95 degrees.

The evaporative pre-cooling system uses the cooling power of evaporation along with our semi-arid climate to reduce energy and demand for large air-cooled systems. This same technology is used to pre-cool the air inlets to utility combustion turbines, to increase their efficiency. The technology will work the same for smaller systems, but the economy of scale makes it appropriate for systems 50 tons and larger.

As the air is cooled, it is also humidified which is a common complaint for "swamp cooler" systems. The difference is that this cooled-and-humidified air is used by the outdoor condensing unit only, and does not enter the building like a swamp cooler does. So, there are no high humidity issues, just energy savings!

The following diagram shows how this simple technology saves energy, by making the condensing unit "think" it is cooler outside than it really is.



Energy Savings and Demand Reduction Using Evaporative Pre-Cooling

What about the water?

Good question! Evaporation does consume water, which is also a precious resource. It is a choice we all make, but from a cost standpoint, the cost of the water evaporated is much less than the energy saved, so economics tells us it is a good trade-off.

In general terms, the cost of the water will "evaporate" about 1/3 of the energy savings dollars, so it's like three steps forward and one back. If the make-up water is metered separately to achieve a utility "Evaporation Credit", then this 1/3 loss is cut in about half.

The actual amount of water used will depend upon how much the HVAC unit is run. Below about 55 degrees, the system is turned off, and of course it needs to be drained each winter to protect from freezing. The following chart will estimate the amount of water used per year. To keep things in perspective, a 1/2 inch water line can easily keep up with a 100-ton evap pre-cooling system.

Evap Pre-Cool System	Cooling Tower (for comparison)
1.5 gal/hr per ton of A/C capacity at max OA temp, reducing to 0.8 gph. Seasonal average approx 1.1 gph per ton. Includes 20 percent bleed.	2.4 gal/hr per ton for evaporation. Includes blow down, drift, and leakage.
Commercial**: 1430 gal per year per ton** of A/C capacity Water Use is +65 percent / -40 percent Commercial	Commercial: **3120 gal per year per ton** of A/C capacity. Water Use is +65 percent / -40 percent Commercial

Maintenance?

Like all evaporative systems, the evaporative pre-cool system requires maintenance. The need for maintenance is mostly due to the build-up of minerals as water is evaporated. A small amount of bleed-off is usually all that is needed to control the mineral deposits. In general, the maintenance is similar to an evaporative "swamp" cooler.