

Johnson Controls® BlueStream™ Hybrid Cooling Systems In Central Chiller Plants.



Optimizing Resource Management



A More Resourceful Solution To Operational Challenges in Central Chiller Plants

Introducing The BlueStream™ Hybrid Cooling System



Waste heat rejection is a major issue, with the dual-edged sword of consuming both valuable energy resources and increasingly scarce water resources.

Water-cooled systems do a great job of handling the high heat-rejection requirements of central chilled water plants. Unfortunately, continuing droughts and global warming are limiting the availability and raising the cost of makeup water used in cooling towers in many regions. Water-cooled systems also generate a large wastewater stream to mitigate buildup of solids in the circulating condenser loop, an issue when municipalities limit allowed wastewater discharge. Permitting can be a major issue blocking new installations in water-constrained areas.

The alternative to using air-cooled chillers can be cost-, space-, and energy-prohibitive, as it requires massive units that are considered less efficient than water-cooled chillers.



What's more, their peak electrical demand on the hottest days is significantly higher – often when electrical costs are at the highest.

Fortunately, there's a better solution: a BlueStream hybrid cooling system that optimizes use of the two cooling technologies in a single operating system. Used in conjunction with a traditional cooling tower, the BlueStream hybrid cooling system can reduce water consumption by up to 80%. It is highly effective across a vast range of weather conditions, as it automatically modulates to utilize the most efficient combination of water- and air-cooled systems (both individually and simultaneously) in response to utility rates, temperature and load demand. The system's modular design is highly scalable, with the ability to add multiple units in parallel to handle a wide range of water conservation requirements. Key core technology within the BlueStream hybrid cooling system is the Thermosyphon cooler, a dry-heat rejection unit designed to work as a complement to your cooling tower system.

The BlueStream hybrid cooling system lets you manage both natural and financial resources with tremendous efficiency. It is equally cost-effective when building a new facility or retrofitting a chiller plant experiencing restricted water resource issues.

Optimized Efficiency:

The BlueStream Hybrid Cooling System

At Johnson Controls, we are passionate about water conservation issues. Finding new ways to be more efficient in the use of this precious natural resource is a priority for us and the customers we serve. Our patent-pending BlueStream hybrid cooling system reduces water use by as much as 80% while minimizing operational costs.

The BlueStream hybrid cooling system adds a dry cooling system to your existing wet system, then coordinates the operation of the two for optimum efficiency, utilizing wet cooling when it's hot and dry cooling when it's not. Intelligent controls allow a combination of the two to run simultaneously in all weather conditions between the two extremes.

Its modular design allows this system to be scaled up to handle the largest of facilities in the most extreme environments.

The system utilizes the Thermosyphon cooler, a dry-heat rejection unit that can be used in an open cooling tower loop or as a dry waterside economizer. Refrigerant circulates naturally through the Thermosyphon process, with no need for a pump or compressor. Freeze protection is accomplished by controlling the refrigerant flow. This system is designed for low maintenance, with an easily cleanable low pressure drop heat exchanger.

Additional advantages include:

- Highly efficient contact with open cooling water
- Low waterside pressure drop (1-4 psi)
- A "W Coil" 12-fan design that allows minimal spacing between adjacent units, reducing plan area requirements
- Smaller installation space and lower relative cost compared with those of competitive units

Compatibility with an existing condenser water system is easily achieved, as evaporator tube metals can be cost-effectively substituted at the design phase before manufacturing. Alternative metals include CUNI, stainless steel or titanium.

Optimizing Resource Management

Measuring Cost-Effectiveness: The WECER Ratio

To fully appreciate the potential operational savings of the BlueStream hybrid cooling system, you have to balance water and energy usage costs. This is expressed as the Water-to-Energy Cost Equivalence Ratio or WECER. Simply put, WECER is cost of water (\$/1,000 gallons) divided by cost of electricity (\$/kWh).

The annual performance of a base-loaded, central chilled water plant was modeled for a mid-Atlantic location. Figure 1 at the right displays several key metrics for three different system types: an air-cooled chiller system, a BlueStream hybrid cooling system and a water-cooled chiller system. Annual average kW/ton, peak system, kW/ton and annual utility operating costs (energy + water) \$/10-ton hours are shown by the red, gold and green bars, respectively. Annual average water usage in \$/ton-hour is indicated by the wide blue bars.

Table 1 compares key system metrics of the air-cooled chiller system and the BlueStream hybrid cooling system with the standard water-cooled chiller system design. As one can see, the BlueStream hybrid cooling system compared with the water-cooled chiller system has the capability of significantly reducing annual water consumption while simultaneously reducing annual utility cost (energy + water). An air cooled chiller system, while having zero water usage requirements, has significant increases in average and peak energy requirements resulting in higher system and annual operating costs.

Flexibility and Functionality

A BlueStream hybrid cooling system can be incorporated incrementally into an existing installation without greatly modifying the existing infrastructure and with minimal disruption to plant operations.

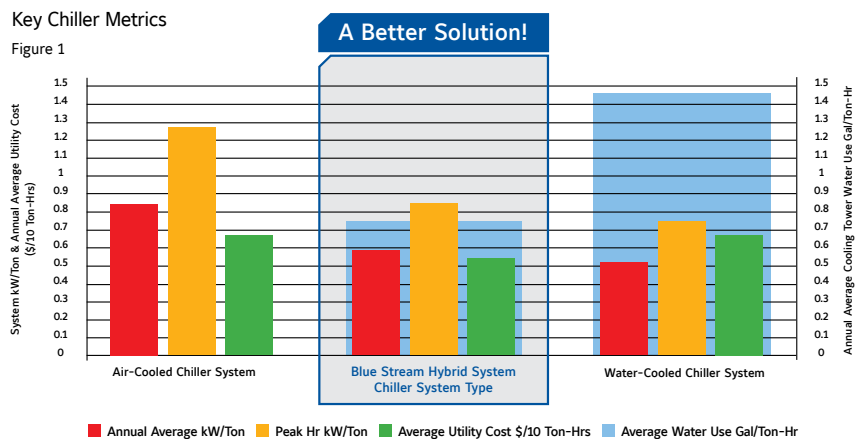


Table 1

System Metric	Air-Cooled Chiller System	Compared to Water-Cooled System	Blue Stream Hybrid Cooling System	Compared to Water-Cooled System	Water-Cooled Chiller System
Annual Avg. Chiller System kW / Ton	0.840	+63.1%	0.591	+14.8%	0.515
Chiller System Peak kW / Ton	1.265	+70.0%	0.848	+14.0%	0.744
Annual Utility Cost \$ / 10 Ton-Hrs	\$0.680	+19.9%	\$0.555	-2.1%	\$0.567
Water Use Gal / Ton-Hr	0.000	-100%	0.743	-49.2%	1.462

A Global Leader in Controls Technology

Johnson Controls provides expert assistance at every stage of your project, from overview, design and manufacturing to installation, training and maintenance support functions. Visit www.johnsoncontrols.com/bluestream for more information.



No need for antifreeze; freeze protection is accomplished by controlling refrigerant flow

High-efficiency premium variable-speed fans

Uses natural Thermosyphon effect to circulate the refrigerant; no intermediate pump required

Freeze-protected single-pass condenser

Highly efficient, low-maintenance insulated shell and tube evaporator:

- Cleanable tubes that enable efficient contact with open-loop cooling water
- Low waterside pressure drop (1-4 psi) minimizes pumping energy
- Auxiliary heaters equipped to add another level of freeze protection
- Alternative tube materials available

Rugged structural steel framing

Industrial-grade NEMA 3R VFD panel

Industry-leading Quantum™ HD control panel designed for dynamically balanced energy and water use to optimize total operating cost



Better Resource Management Through Hybrid Technology



Our BlueStream hybrid cooling system combines air-cooled and water-cooled heat rejection systems with advanced controls, reducing water usage by up to 80% while optimizing efficient energy use. Excellent for either new or retrofit applications.



Power Generation Plants



Petro/Chemical Manufacturing Plants



Data Centers

Warranty and Support


Johnson Controls supports customers at thousands of worldwide locations with full parts and service capabilities to provide exceptional responsiveness.

Contact Us for a Quote

For a quote or further information about the BlueStream hybrid cooling system, please email BE-Bluestream@jci.com.

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