Aligned Energy

Power Shift: Why data centers must move from reducing energy to controlling water

by Marcus Moliteus

After attending a data center industry event earlier this year, and speaking with leading engineers from around the country, it struck me that there was very little conversation about reducing water in the data center. I broached the subject with several attendees, and while everyone agrees that data centers have a drinking problem - so to speak - there are not a lot of solutions to address water usage because the conventional approach usually involves a trade-off with the use of more energy. Using more energy to solve a water problem is not sustainable.

Our industry will always grapple with the age-old power-hungry problem that is the data center. By its very nature, the industry requires a massive amount of resources to deliver services. As a result, industry groups such as American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), have focused on rising energy concerns with guidelines focused on solving for power through usage and temperature standards. The industry is also constructing greener buildings and innovating cleaner designs. All together data center "Power Usage Effectiveness" (PUE) has significantly decreased over the past 10 years.

While it is a positive development that overall energy for data centers is being reduced around the globe, a key component that has - for the most part - been washed over is water usage. One example of this is the continued use of open-cell towers. They take advantage of evaporative cooling to cool the air with water before it goes into the data center. And while this solution reduces energy, the water usage is very high.

Raising the issue of water reduction is the first step in creating ways our industry can do something about it. As we experience the continued deluge of the "Internet of

Things"—projected to exceed 20 billion devices by 2020, we will only be able to ride this wave if we keep energy low AND start reducing water usage.

The heat is on for free cooling

The first question becomes how can cooling systems reject heat more efficiently?

Let's say heat is coming off the server at 100 degrees Fahrenheit. The idea is to efficiently capture heat and bring it to the atmosphere as close to that temperature as possible - but it is all dependent on the absorption system. If water is brought back at a temperature in the high-90s, the system can do an enormous amount of economization of the atmosphere without having to use a lot of water to cool it down any further. The air temperature outside the data center will likely be at 95 degrees F and above for only a portion of the year, but for the majority of the year, it will be below that. That creates "free cooling" without having to turn on water, except when absolutely needed.

At Aligned Energy, we've designed our free cooling and the mechanical portion in series with each other. Our patented system provides full or partial free cooling all year long. This ability to constantly deliver free cooling lowers the overall amount of power the compressors need to use to cool the water.

Sacrificing water versus power

Obviously traditional data center cooling systems use water. And while we can't change the physics of how many BTUs versus how much water is used, we can control them. By doing this, we can also achieve greater efficiencies. If the external air temperature gets too hot and a data center wants to keep its PUE down, water is turned on. It's that simple.

Apply this scenario throughout an entire year. Outdoor temperatures can run up to 100 degrees F plus. At Aligned Energy, we can maintain an industry-leading annualized PUE of 1.15 (PUE of 1.0 is nearly perfect). However, if the outdoor temperature rises to 120 degrees F in Phoenix, Arizona, the PUE will spike. Imagine if, at that point, the client could choose whether to use water for a limited number of hours and continue to keep the PUE low while having a small WUE (water usage effectiveness).

With traditional cooling solutions, high water usage is necessary due to the systems requiring water for a majority of the year to operate at the same efficiency on higher temperature days. Some data centers create efficiencies at higher temperatures by allowing room temperatures to rise into the high 80s and 90s. However, that creates a whole realm of issues for clients, including higher risk of failure for servers, corrosion or mold spores and bacterial growth on the servers. The ability to optimize the usage of water versus power when needed helps to solve these risks.

A tale of two features

As water-cooled servers increasingly enter the market, it is not enough to merely say a data center offers low-water cooling systems. Sophisticated hyperscale clients, for example, require an overall efficient platform that also delivers reliability and flexibility.

Reliability is a key characteristic of most data centers. I've experienced many complex systems designed to deliver 100% uptime, but ironically these complex systems often lead to more failures because human-error is usually the root cause. Simple and efficient designs make a lot more sense from a reliability perspective, both electrically and mechanically. At Aligned Energy, we've adopted this approach to our electrical and mechanical topologies. For example, we've enacted a closed-door environment—that is, economizing without bringing in outside air.

Temperature is controlled and maintained at the same temperature year-round in our data halls. It doesn't matter whether it is zero degrees outside or 120 degrees F. Our data hall is maintained at 75 degrees F and 45 percent relative humidity. This is

one small example of how we've been able to demonstrate both efficiency and reliability.

Another important factor in cooling data centers is flexibility. Data centers must be able to efficiently scale vertically and horizontally, adapting to varying densities and workloads, to meet the needs of its clients. I hear the same question again and again, "Our current IT load is at five to eight kilowatts per rack, but our IT group wants to drive higher density, doubling that. What do I do?" Our approach is to offer flexible ramp terms in a future-proof environment where they can grow vertically and densify without investing in more real estate. Thus, clients have the flexibility to scale-up versus out. Expanding vertically in the same footprint is far more efficient and economical than taking down more data center space. Traditional cooling methods are not able to accommodate increasing density inside the same footprint.

We also hear from clients that they are usually required to design their IT stamp around the capabilities of their data center provider. Fortunately, at Aligned Energy we tune the data center to fit the client's workload both now and in the future with our efficient and reliable platform. We're able to provide maximum flexibility in an energy and water efficient-way without sacrificing reliability.

Looking into the future

The digital economy is driving compute densities upward and meanwhile the need to become more efficient by every measure is increasing. Aligned Energy has clients who are achieving 40-50 kW per rack and providing a 40-degree delta T across that server. A higher delta T is more efficient. Traditional data centers require additional systems to be added and the workload is spread out to manage that kind of heat. Thus, more water, more energy and more space are consumed.

Developing innovative ways to save water, without increasing energy usage is an important next step in our industry. We must continue to innovate and create ways to control water consumption. My guess is that just as PUE numbers have steadily declined over the years and are a popular topic of discussion at every industry conference, WUE or water usage effectiveness is poised to follow suit.

Shifting the conversation from power to water usage is critical. As an industry, we must care about water usage, not just energy reduction. We must create ways to control water consumption and go beyond reaping cost and resources efficiencies for today but transform the industry for the future.

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About Aligned Energy

Aligned Energy is an infrastructure technology company that offers colocation and build-to-scale data center solutions to cloud, enterprise, and service providers. Our intelligent infrastructure allows us to deliver data centers like a utility—accessible and consumable as needed. By reducing the energy, water, and space needed to operate, our technology innovations offer businesses a competitive advantage by improving reliability and their bottom-line, while helping secure the health of the planet.