WATER & DATA CENTERS

A summary of BlueTech Research's Insight Report

Every email sent, picture posted, or piece of data uploaded is done so using bits processed at a data center. As the internet adds more users, and the internet of things (IoT) is woven into every aspect of business, demand for data center capacity is expected to grow exponentially. As data centers expand, so too will their water requirements.

This article summaries the findings of BlueTech Research's Insight Report, Water & Data Centers, which investigates the relationship between data centers and water and maps out the technologies and strategies available to minimize environmental impact. It also identifies opportunities for the water sector.

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BlueTech Research

BlueTech Research is an independent water technology market intelligence firm.

Introduction

Global consumption of data is growing at a breakneck speed. Data centers (DCs) are the physical infrastructure which enable our digital universe to grow. The future need for DC capacity is driven by consumer demand for content, e-commerce, and the seamless integration of IoT devices, plus the drive to industry 4.0 automation and data exchange solutions.

Because of this demand, there is a trend towards increasing the power density of the racks that house DC servers and other components, which in turn increases heat generated and subsequent power and cooling requirements. Traditionally, the cooling systems that provide chilled water to the high-volume air-handling units installed in data centers have been centralized.

Having access to secure, high quality water supplies is critical to supporting growing DC capacity, as well as daily operations.

The Challenge

DCs use water, both onsite for cooling, and through the off-site generation of electricity required to power operations. Between 2010 and 2018, global electricity consumption attributed to DCs is estimated to have grown at a modest CAGR of 0.7%, despite a quintupling of computing power.

A US Department of Energy study estimated water consumption in 2014 to be 626 billion liters, a number this report estimates to have declined to 295 billion liters in 2020. This can be attributed to the 'greenification' of the grid and improvements in thermoelectric power generation efficiency.

This decline in water consumption is indeed positive, but the macro-trend does not highlight the issues seen at the micro-level. Historic revenues of tech companies, along with water withdrawal and water consumption metrics for datacenters indicate a troubling trend emerging among the investigated tech giants; water productivity – defined by the authors as *the revenue generated by withdrawing or consuming a unit of water* in a DC – is decreasing.

While power efficiency has improved over the past decade, companies have not decoupled operational growth from direct water use.

Indirect water consumption can be distributed and decentralized away from municipalities. However, as DCs hyperscale, become more consolidated and edge closer to municipalities for faster response times, direct water consumption at the micro-level of each DC creates significant tension between DC owners.

Typically these operations rely on water from local municipalities and are competitors for existing water sources. These tensions may cause the public to hesitate when considering permission for a new DC to be constructed. Use of municipal potable water for DCs represents a major waste of water and energy.

As large DC owners seek to justify their social license to operate and mitigate conflicts with local water competitors, adapting alternative water sources will become a priority.

Solutions

Promising alternative sources of water include tertiary effluent - which can be purchased at a significant discount to municipal potable water – along with greywater, blackwater, and rainwater. In 2019, Apple and Facebook used 0.4 and 0.85 million cubic meters of recycled water respectively.

The use of alternative water often requires pretreatment to make it suitable for cooling process water. These sources will first be integrated in areas of water scarcity and it is significant that nearly 50% of DCs are in high-risk areas.

Besides the uptake of alternative sources, water use can be minimized through advances in cooling and air-handling technologies.

New DCs are increasingly opting for completely dry cooling systems as opposed to traditional evaporative systems.

While dry systems reduce direct water consumption, additional energy consumption may inadvertently increase indirect consumption, depending on the power source. Other emerging alternative cooling systems include liquid and immersion systems.

These emerging systems eliminate the need for onsite water treatment and pose a threat to sales of traditional cooling and treatment systems, but are still 5-10 years away from achieving widescale adoption.

The top-tier suppliers of cooling equipment and systems for DCs are listed in the full Insight Report. More familiar to the water industry will be the providers of water treatment services, technologies and products. The table below lists a selection of some of the main players targeting the DC sector.

Company	Products
Chem-Aqua Inc	Custom-designed, turnkey water treatment programs for boiler, cooling and process water systems
ChemTreat	Chemical programs to mitigate corrosion, scaling and/or fouling in cooling tower systems. Also offers a variety of pre-treatment filtration systems
Ecolab-Nalco Water	Cooling tower system optimization technology (3D Trasar), a variety of pre-treatment filtration systems
Inframark	Cooling tower water pre-treatment systems
Kurita Water Services	Integrated cooling tower systems, pre-treatment filtration systems, chemical feed systems
SUEZ Water & Technologies	Custom-designed, turnkey water treatment programs for boiler, cooling and process water systems

There are several areas for innovation related to water in the industry, two of which include the implementation of smart water meters and alternative materials and/or coatings for cooling tower equipment. The majority of DCs today do not collect water data - smart water meters are required to enable reporting on water metrics and can also be integrated into heating, ventilation and air conditioning (HVAC) SCADA systems for optimization of the cooling process.

Alternative materials and/or coatings for cooling tower equipment can mitigate or eliminate the need for pre-treatment in cases where alternative water sources are used. *Areas for innovation in the DC space as they pertain to water are outlined in the Insights Report.*

To maintain the rapid expansion of DC capacity, owners must prove their commitment to sustainability by providing better transparency around water use. With metrics openly available, DC owners can implement systemic water-saving programs by incorporating alternative sources of water and the technologies which enable their use; and/or by adapting waterless cooling technologies.

These steps not only serve to mitigate future water quantity conflicts, but also ensure the sustainability of water resources.

Actions for C-suite executives

Chief technology officer: For water treatment and/or cooling system providers, unmet technological needs include non-chemical environmentally-friendly technologies for the treatment of cooling water, digital metering products that integrate into DC HVAC systems and materials that mitigate the need for cooling water pre-treatment. There are opportunities to implement emerging cooling technologies to mitigate direct and indirect water consumption.

Acquisition/partnerships manager: Providers of cooling equipment and components that operate efficiently and which eliminate or mitigate the need for water pre-treatment will have a competitive advantage over those that do not.

R&D manager: Advances in materials would reduce the need for traditional treatment chemicals such as corrosion inhibitors and biocides.

Cooling technology manufacturers and solutions suppliers

- Develop and commercialize more water-efficient cooling technologies and next-generation cooling solutions
- Include as standard the necessary submeters and sensors for all cooling process water consumption that enable regular measuring and tracking of water usage

Manufacturers of smart water meters, sensors and control systems

- Develop and commercialize meters and sensors which operate reliably with alternative water sources for DCs and control systems that measure and aggregate total water consumption and calculate water-use efficiency (WUE)

Water services companies

- Develop and launch non-chemical, environmentally-friendly water treatment for cooling
- Develop solutions for more onsite water recycling and reuse for cooling
- Provide cost-effective options to help the 50% of DCs not presently measuring water consumption
- Evaluate suppliers of smart water meters and other water sensors to determine those that have products that help better serve existing DC customers. Develop partnerships with best-in-class suppliers

DC owners and operators

- If using local utility potable water for cooling, identify alternative sources of process water and assess attractiveness and sustainability of options
- Measure, track and report water withdrawal, consumption and WUE as proof of company's commitment to efficient use of water in cooling and operations. Develop measures to decrease water consumption and improve WUE
- If already calculating and reporting WUE, develop a plan to measure and track. Explore options for renewable energy supplies
- Use continuous improvement in WUE and PUE (power-use efficiency) as differentiation and proof of company's commitment to sustainability. Incorporate pledges to maintain and improve WUE and PUE into service agreements with DC customers
- Evaluate the feasibility of newer, less water-intensive cooling technologies and develop plan to retrofit over time

Customers of DCs

- Demand that your DC tracks and reports WUE and complies with and supports the company's sustainability objectives.

For more information about the Water and Data Center Insight report, visit https://www.bluetechresearch.com or email info@bluetechresearch.com