Resfriamento Líquido para Aplicações de Inteligência Artificial

Fabio Olivetti
CW & HD Offering Manager LATAM
Vertiv

DATACENTER
FORUM BRASIL 2025
Tecnologias avançadas para a inovação na indústria dos Data Centers

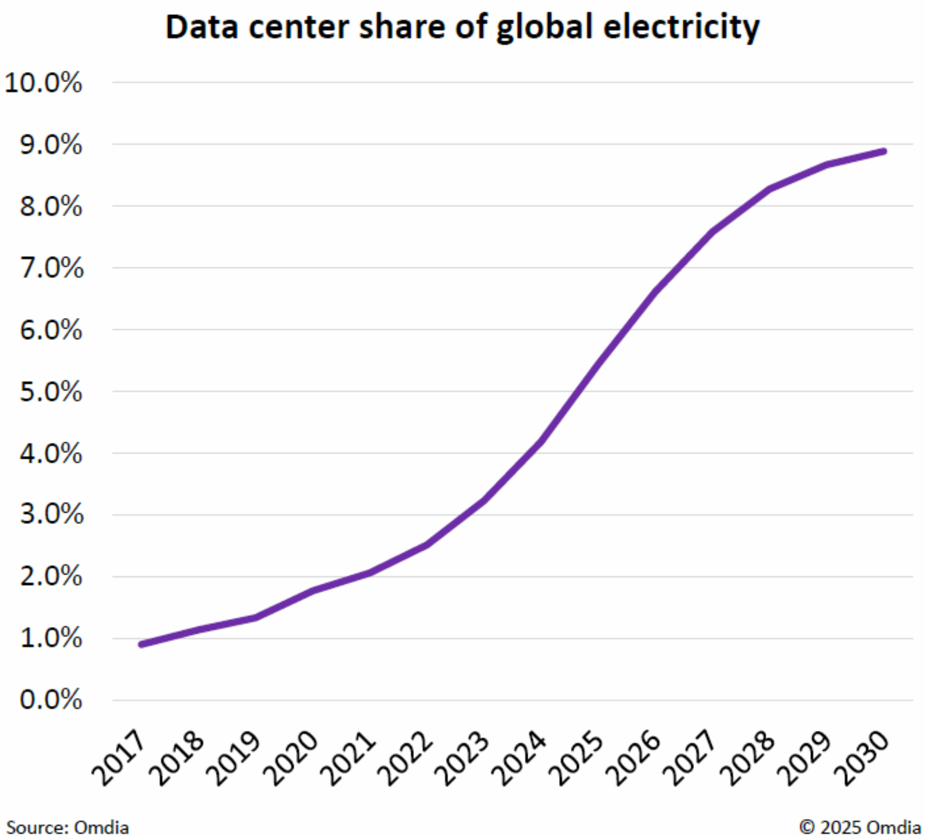
BICSI CALA

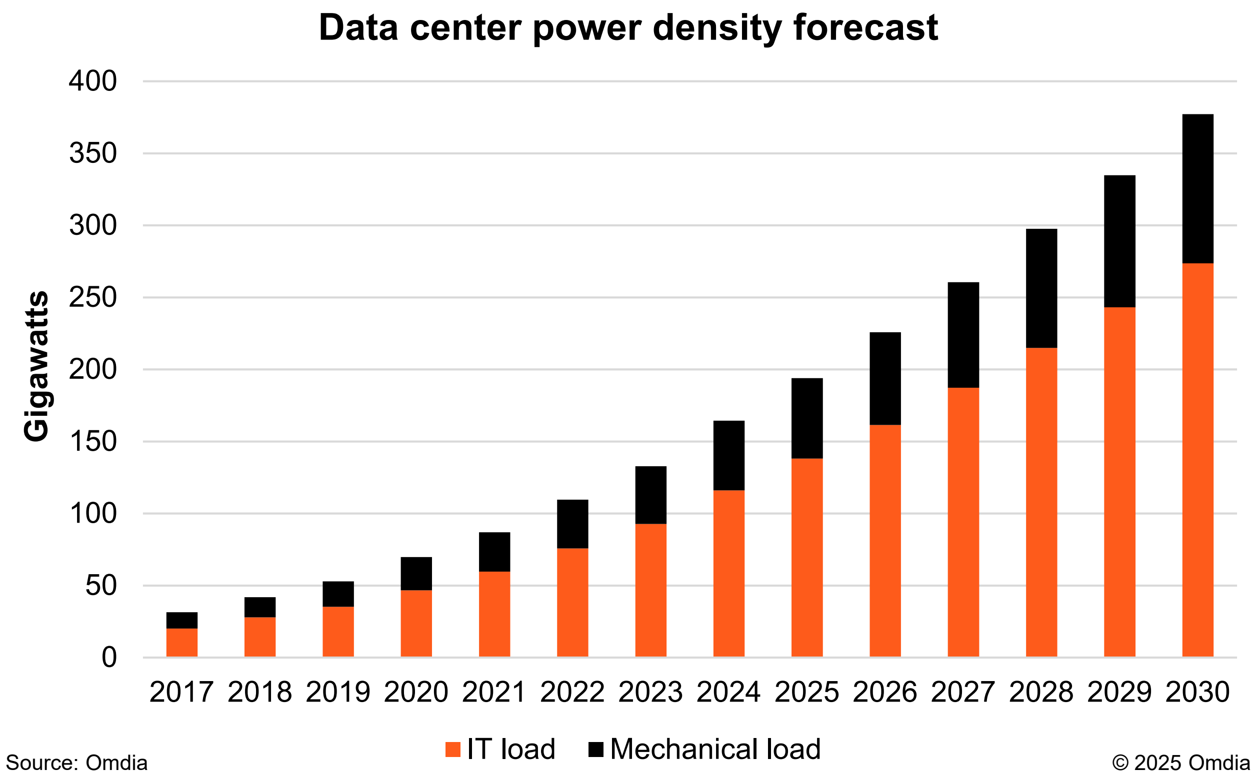
Cooling Systems in High-Density Data Centers

Innovations Enhancing Efficiency in Data Center Cooling

Fábio Olivetti
Gerente de Produtos LATAM – Água Gelada & HD

Data Center Power Growth





Source: Omdia DCPI Market Update - Vertiv _ 20250116 1

VERTIV.

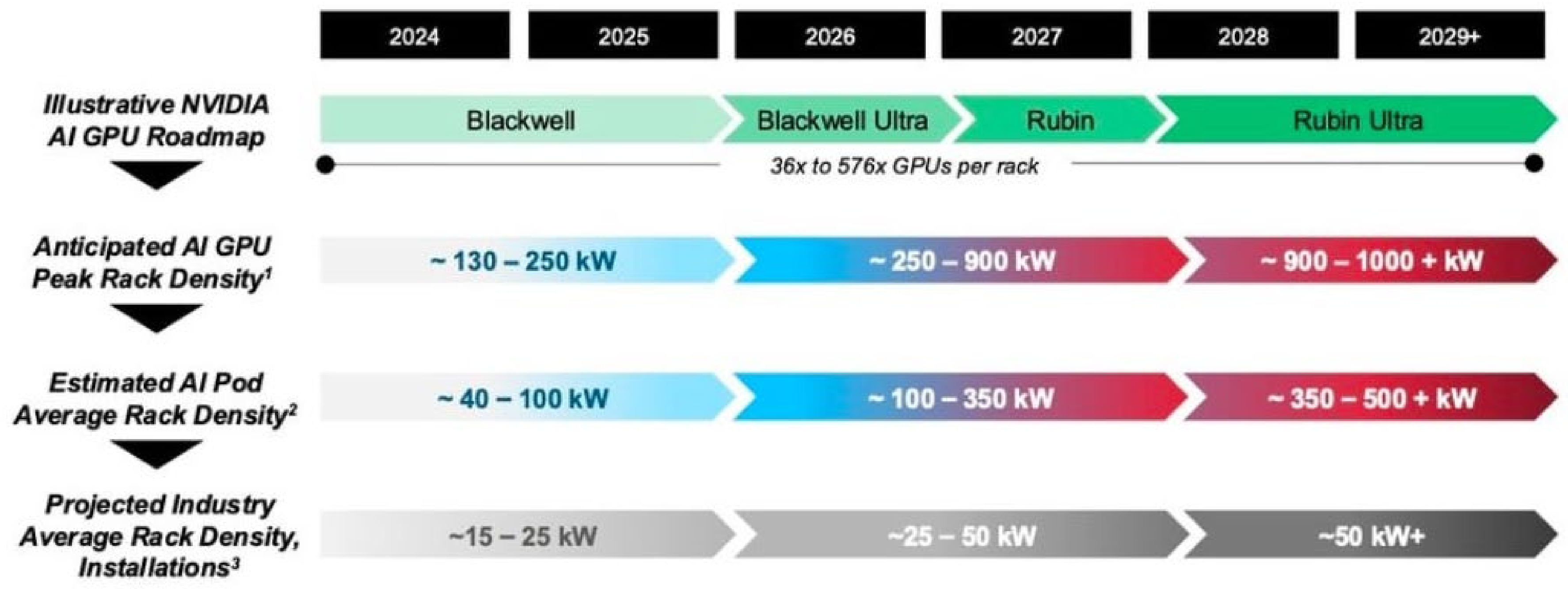
BICSI CALA

Data Center Power Growth

- IT load capacity expected to exceed 270 GW by 2030, with a focus on high-density solutions (>50 kW/rack)
- High demand for scalable and efficient cooling solutions
- Energy distribution infrastructure does not serve all Data Center implementation regions, requiring considerable investments to meet demand

Data Center Rack Load Growth

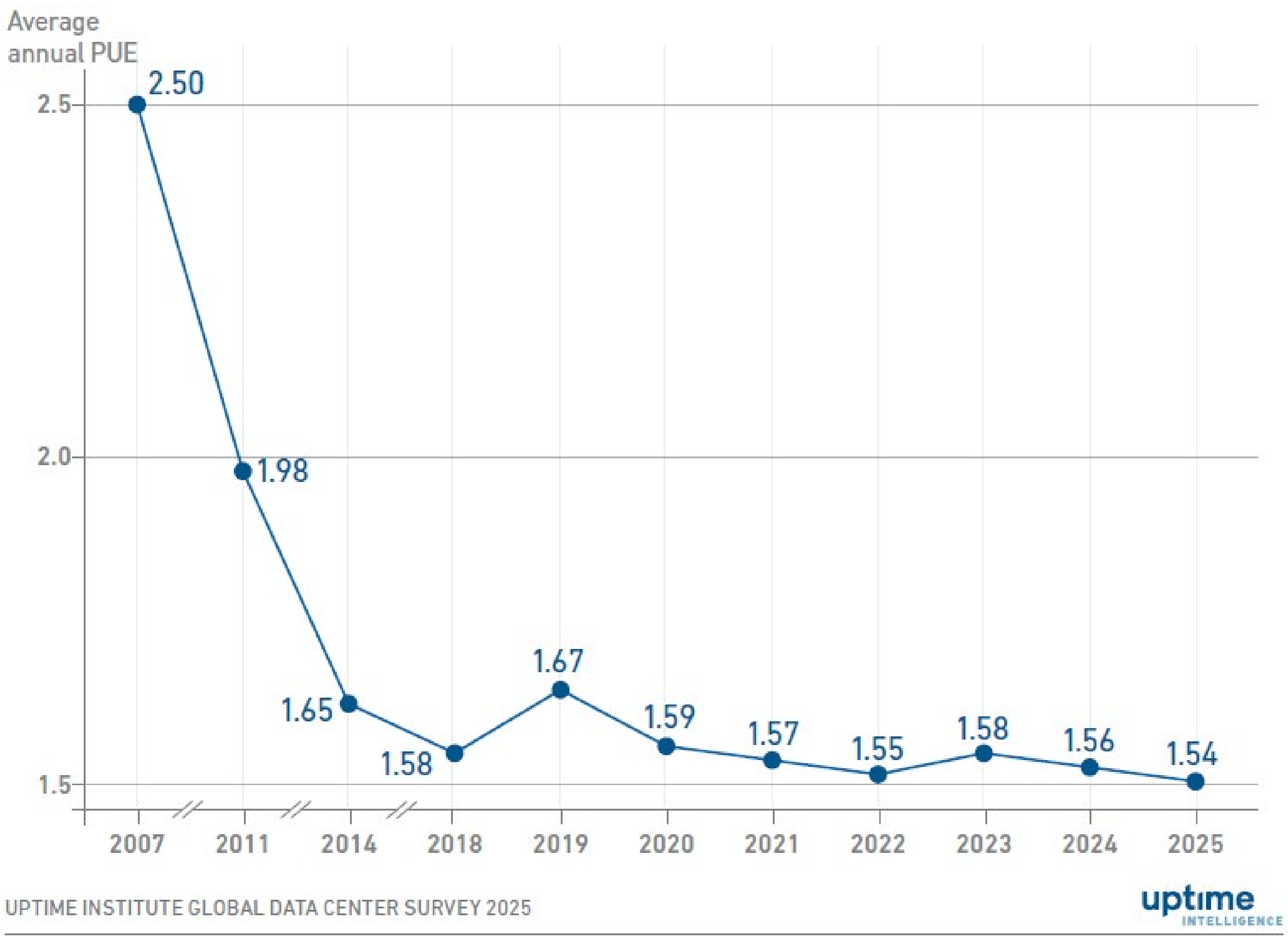
Anticipated increases in extreme and overall industry rack densities



Note: Projections. Rack density varies by application. [1] Management Estimates; [2] Management Estimates, assuming an AI pod consisting of 18 racks (9 per row) including 8 GPU racks at higher peak density and 10 networking racks; [3] Management Estimates; average densities of data center rack installations across Cloud, Colocation and Enterprise/Distributed IT.

Densification roadmaps point to extreme peak rack densities of 1MW+ resulting in estimated new build average rack density increasing across varying workload applications and market segments

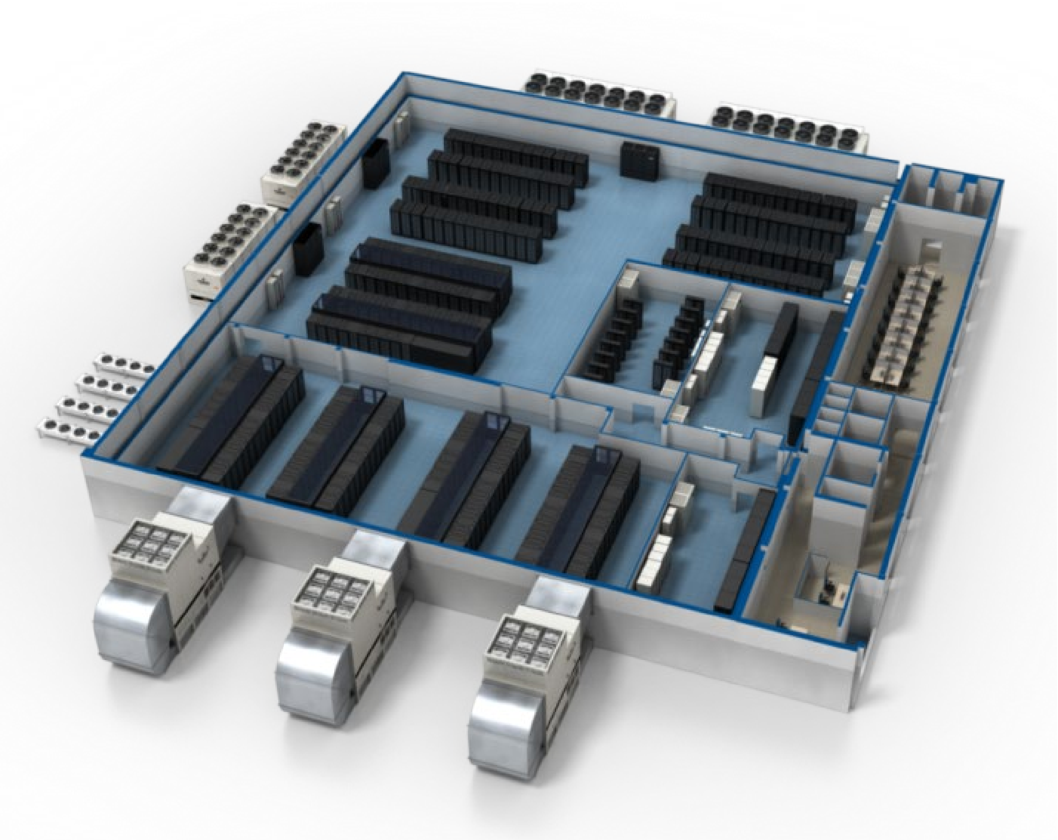
Average Global Data Center PUE



Source: Uptime Institute Global Data Center Survey 2025 (Uptime, Jul 2025)

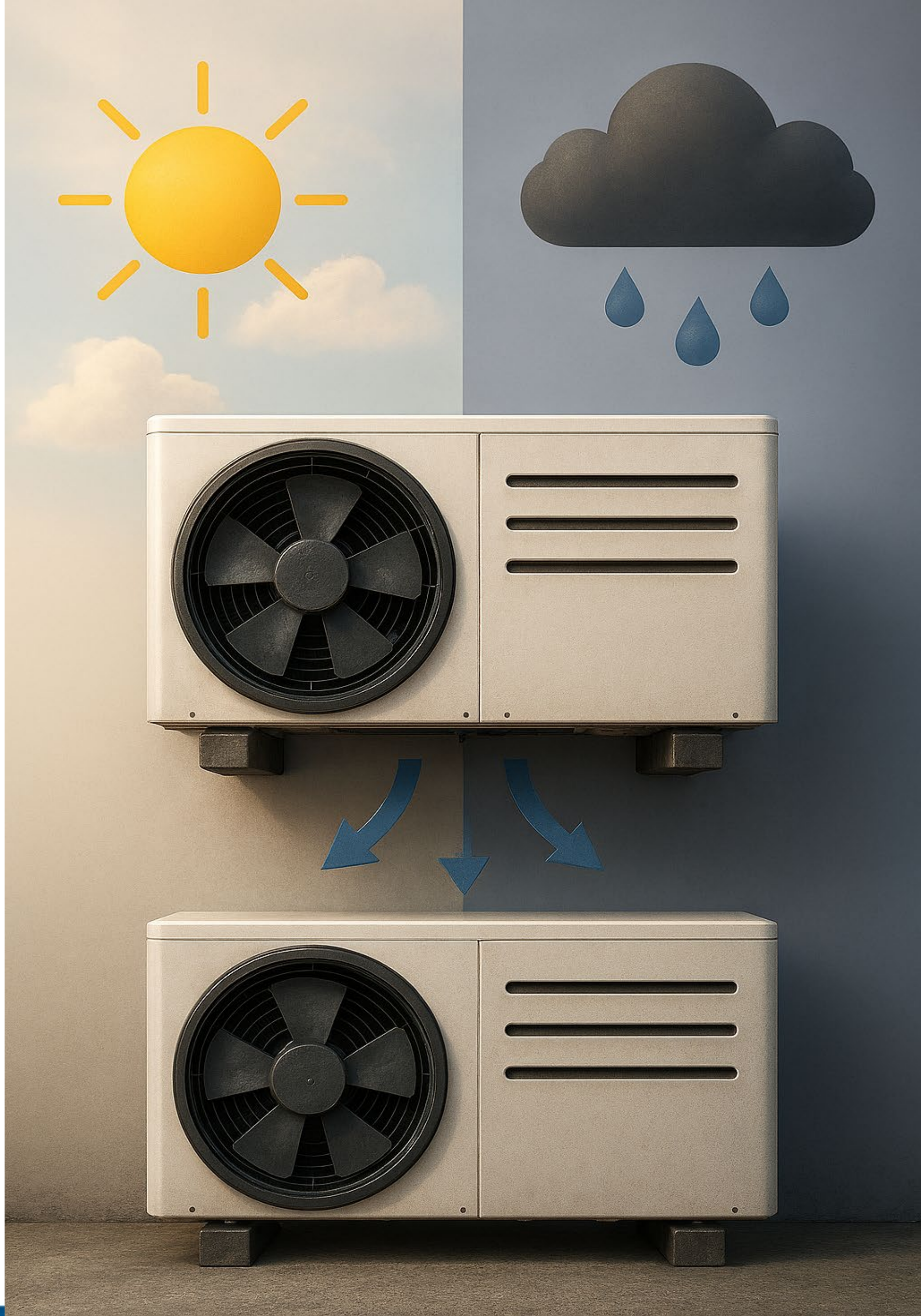
Data Center Architecture

- Racks with a density greater than 50 kW are being designed, which are not feasible for air cooling
- It is necessary to review the physical structure of the Data Center, with the use of raised floors or overhead pipes for the distribution of Liquid Cooling, in addition to the electrical distribution by airway, to support the new systems
- Positioning CDUs close to racks to reduce liquid distribution structure
- Increased ceiling height for positioning and installation of critical air conditioning and electrical distribution systems



Brazilian’s Weather Conditions

- Summers with average temperatures of 22–26°C, which can exceed 30°C
- Winters with averages of 13–18°C, with little opportunity for free cooling, if considered traditional systems (air cooling)
- Tropical and humid climates reduce the efficiency of air cooling
- Liquid cooling becomes attractive in these conditions, especially considering the increase in Data Center capacity
- Water scarcity in urban centers drives Closed-loop Liquid Cooling systems, reducing water consumption (zero water consumption)
- Government regulations encourage Liquid Cooling, due to higher Energy Efficiency Index and reduced PUE



Liquid Cooling Technology Adoption

- Direct-to-chip Liquid Cooling system with high demand (high-density workloads)
- Zero water consumption with today's closed-loop solutions
- Reduced energy consumption and carbon footprint
- CDUs regulate liquid flow, monitor temperature, and enable real-time thermal control.
- Facilitate the gradual transition to liquid cooling, even in hybrid environments (traditional + liquid)

Overview of Sustainability in Data Center Cooling

Cooling Technologies Comparison

Traditional and modern cooling systems are compared to highlight energy and water usage differences in data centers.

Sustainability and Water Usage

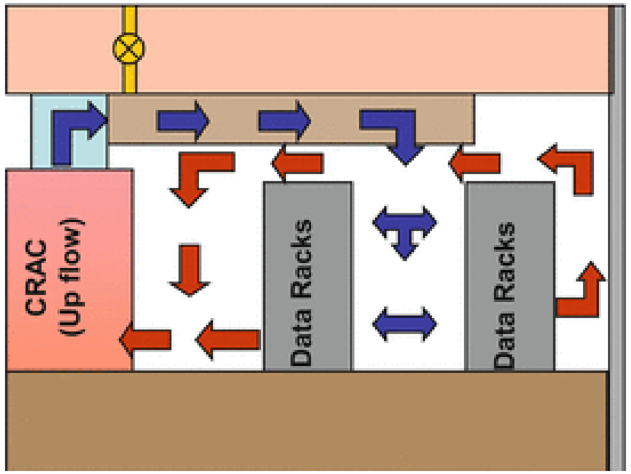
Focus on reducing water consumption in data center cooling to minimize environmental footprint and conserve resources.

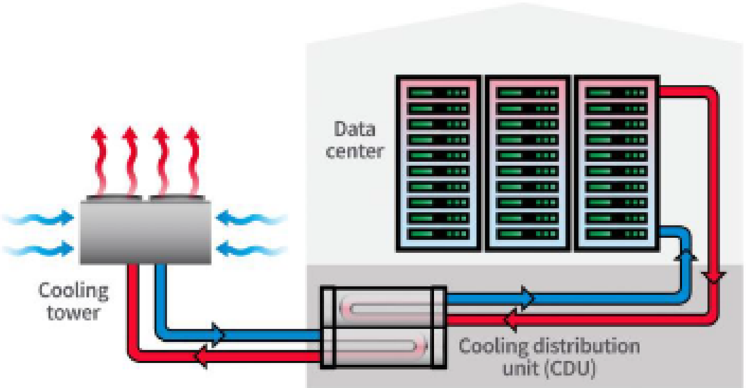
Innovations in Cooling

Latest innovations improve energy efficiency and reduce environmental impacts in high-density data center cooling.

Strategic Guidance

Future data center projects adopt best practices to minimize energy and water consumption and enhance cooling sustainability.





Liquid to Liquid
Scalable to Data Center
Direct to Chip (D2C)

Traditional vs. Modern Cooling Technologies

Water Consumption in Traditional Cooling

- Evaporative cooling systems (e.g., cooling towers, adiabatic economizers) can consume up to 1.5 million liters per day per facility.
- A 100 MW hyperscale data center may use 2 million liters/day, equivalent to the water usage of 6,500 homes.

Energy Consumption in Traditional Cooling:

- Traditional cooling system has an average EER (Energy Efficiency Ratio) of 3.
- A 100 MW hyperscale data center may have a cooling system energy consumption of 33,3 MW.

Closed-Loop Liquid Cooling: A Game Changer

- Modern liquid cooling systems are closed-loop, meaning:
  - Water is filled once during construction and then recirculated, requiring minimal top-up.
  - These systems eliminate evaporative loss, drastically reducing water footprint compared to traditional methods.
- They are also much more energy efficient:
  - The EER of a liquid cooling system can reach up to 100.
  - These systems can reject much more heat consuming only a fraction of energy.

Liquid Cooling Design and Energy Usage

Higher Heat Transfer Efficiency

Liquid cooling dissipates heat more effectively than air cooling, reducing the power needed to maintain optimal temperatures.

Reduced Fan Usage

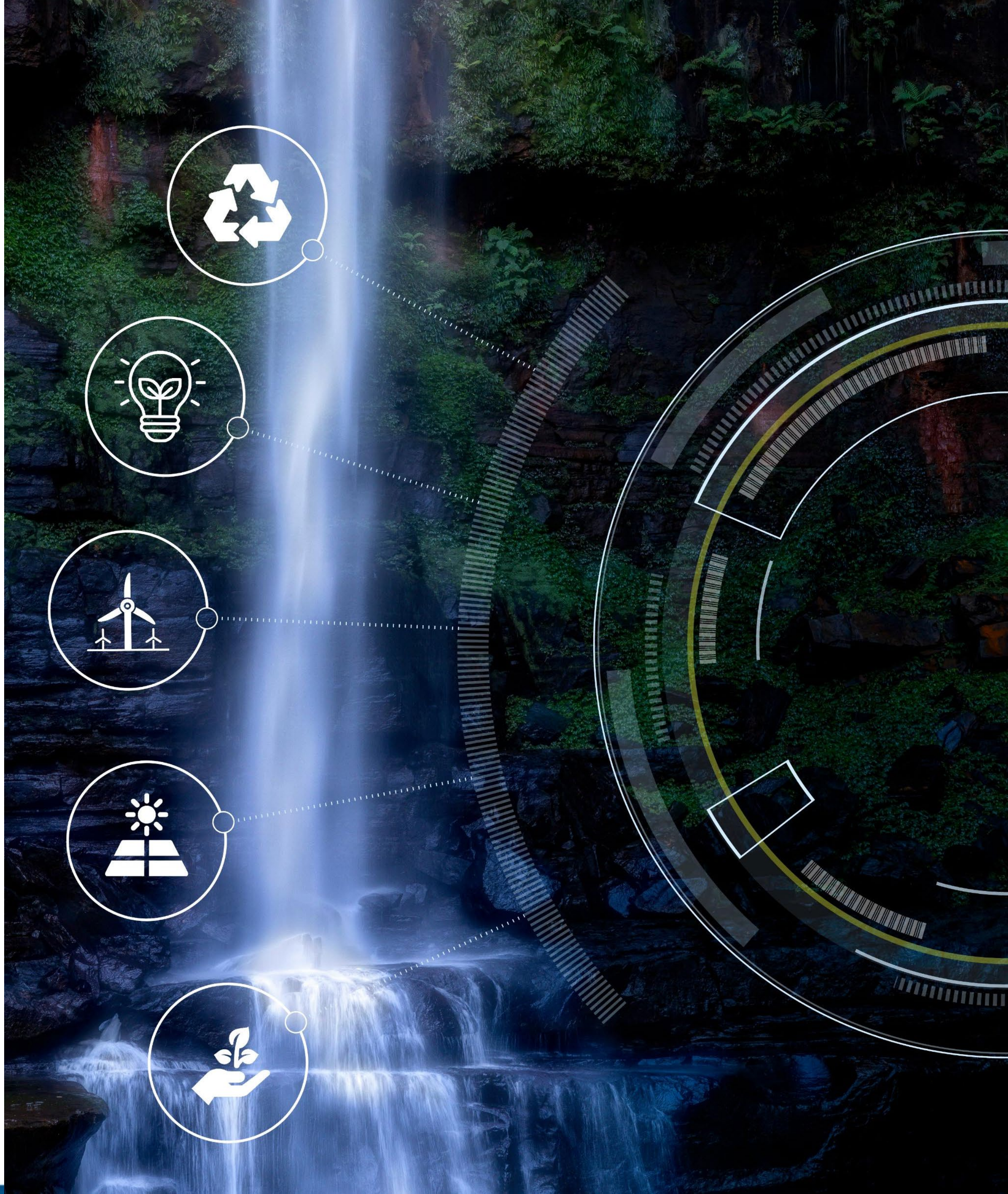
Lower fan speeds and fewer fans decrease overall energy consumption in liquid cooled systems.

Enhanced Performance and Longevity

Improved thermal management prevents overheating and hardware failure, boosting system performance and lifespan.

Support for Sustainability

Liquid cooling reduces carbon footprint by minimizing energy waste and promoting greener IT infrastructure.



VERTIV

Energy Usage Comparison of Traditional vs. Liquid Cooling Technologies

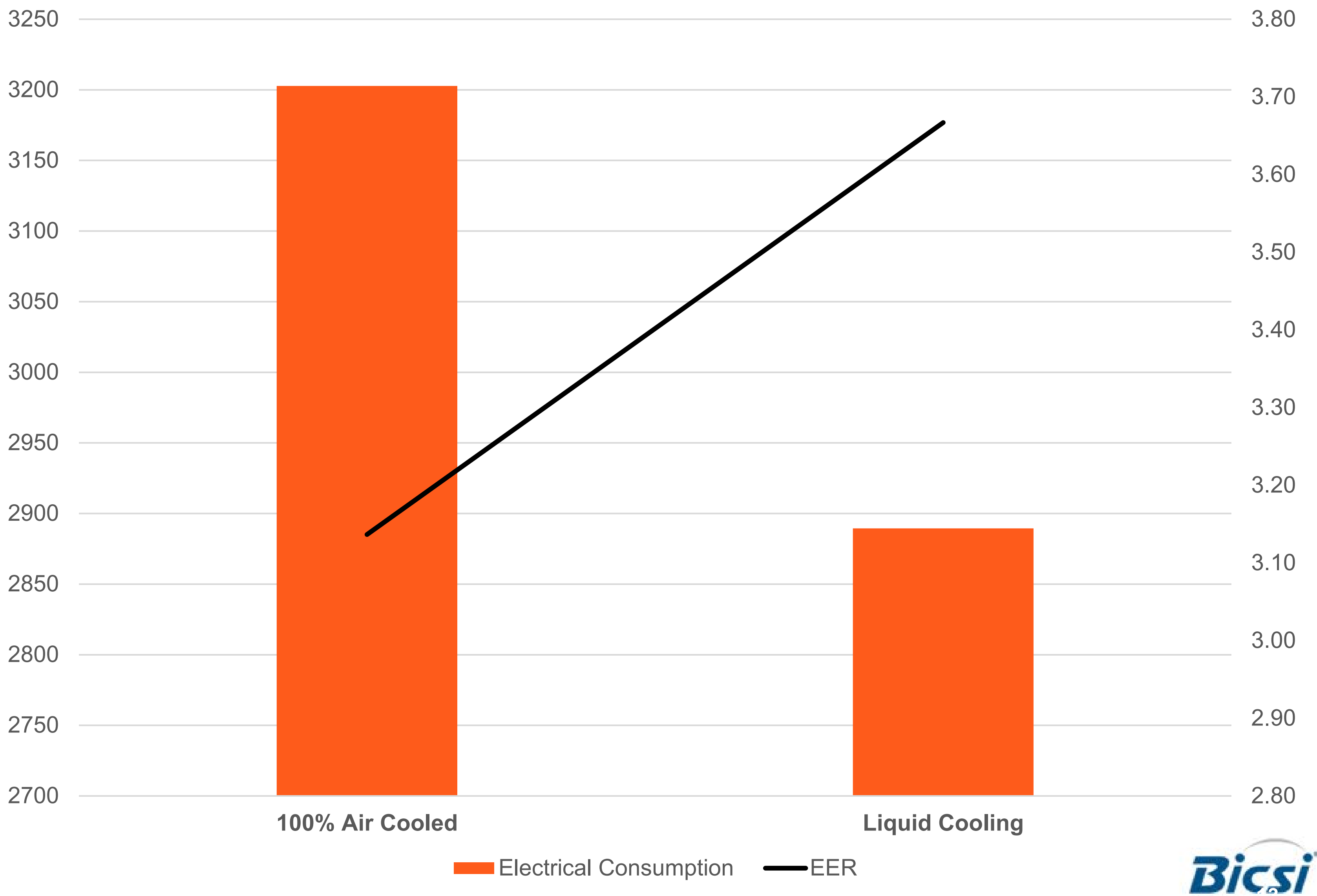
10MW Data Center

Traditional Cooling System:

- 1,1MW Chillers x9 units
- 460 kW Fan Walls x22 units

Liquid Cooling System

- 1MW Chiller x8 units for Liquid Cooling CDUs
- 1MW Chiller x2 units for Fan Walls
- 1MW CDU x8 units for Liquid Cooling servers
- 460 kW Fan Walls x5 units for Air Rejection



VERTIV

BICSI CALA

Advanced Cooling Technologies

Innovative Cooling Methods

Direct-to-chip and immersion cooling technologies enhance cooling efficiency in high-density data centers.

Two-Phase and Hybrid Systems

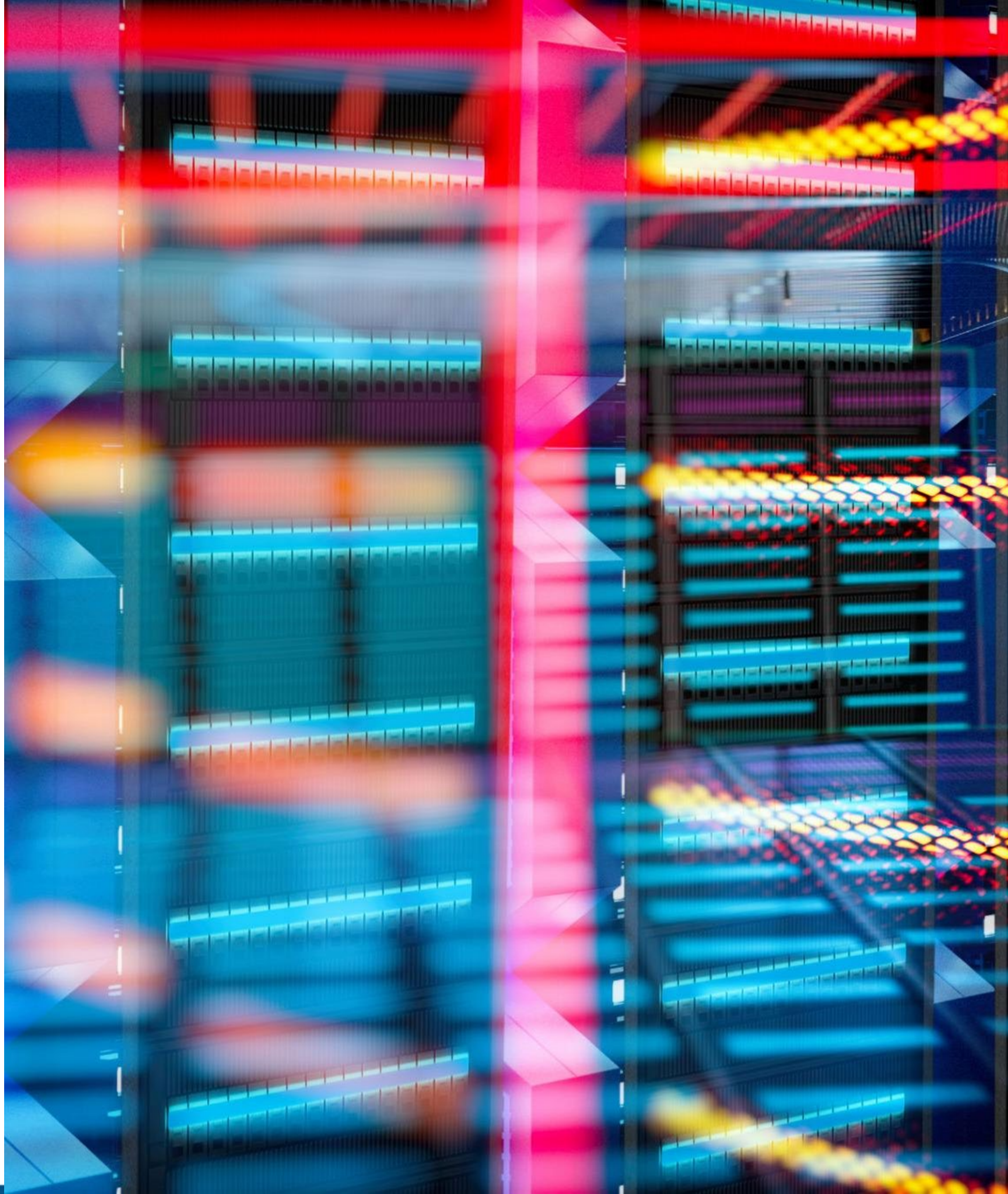
Two-phase cooling and hybrid strategies optimize performance while promoting sustainability in cooling operations.

AI-Driven Thermal Optimization

AI analytics optimize thermal zones and airflow to improve energy efficiency in data centers.

Heat Reuse Initiatives

Waste heat from cooling systems is repurposed for community applications, reducing energy waste.



VERTIV

Fábio Olivetti
+55 11 94797 7898
fabio.olivetti@vertiv.com