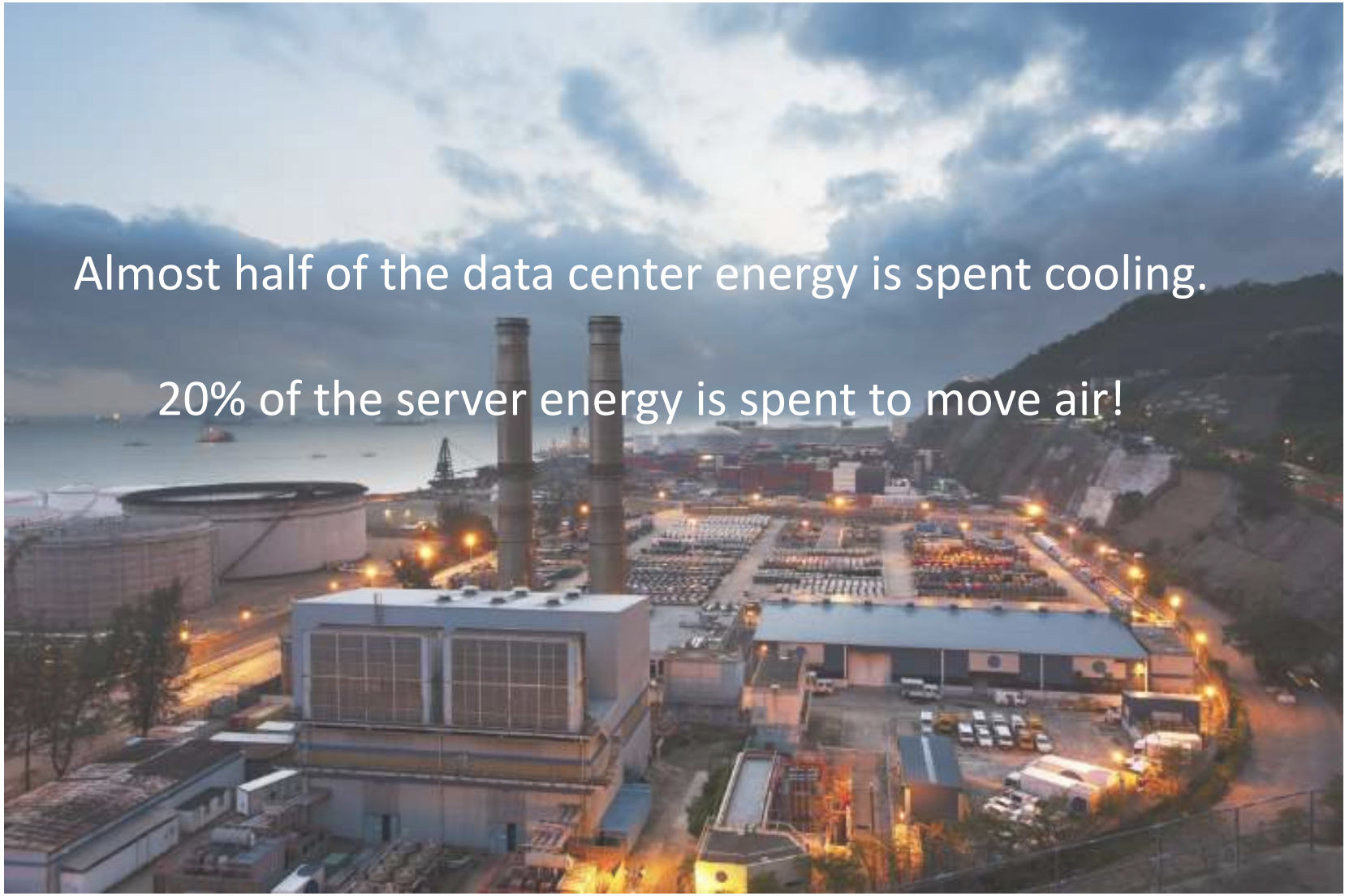
ZUTACORE®

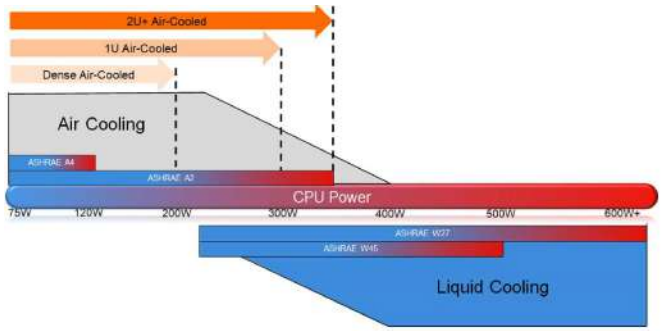
More Power for AI Workloads with Energy-Efficient End-to-End Two-Phase Cooling

Unlocking Performance, Efficiency, and Sustainability

Data Centers and Computers are Wildly Inefficient



AI Workloads are Mandating Liquid Cooling



AI chips already at 500W – 750W TDP

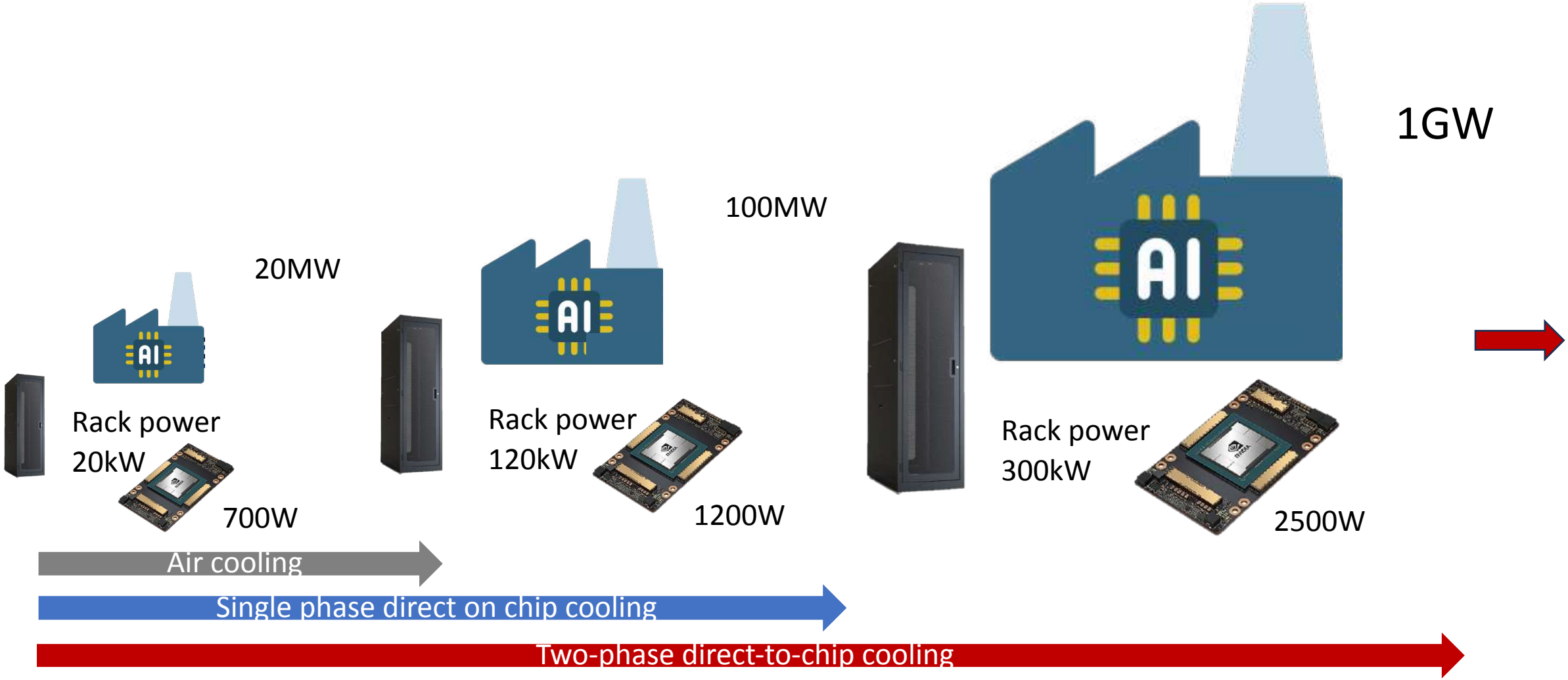
Scarce power resources and associated costs

Data center buildout time, rising costs, and at capacity

Sustainability and zero emission drivers

LIQUID COOLING FOR SUSTAINABLE AI

Traditional Air Cooling No Longer Feasible for AI Growth



HyperCool® - More Performance, Energy, Savings

A unique two-phase, closed-loop liquid cooling solution

Two-phase Cold Plates – NVIDIA, Intel, AMD

Direct-to-chip cooling supports 2800 watts and beyond

Manifold

Transports fluid/vapor to & from the cold plate

Heat Rejection Unit

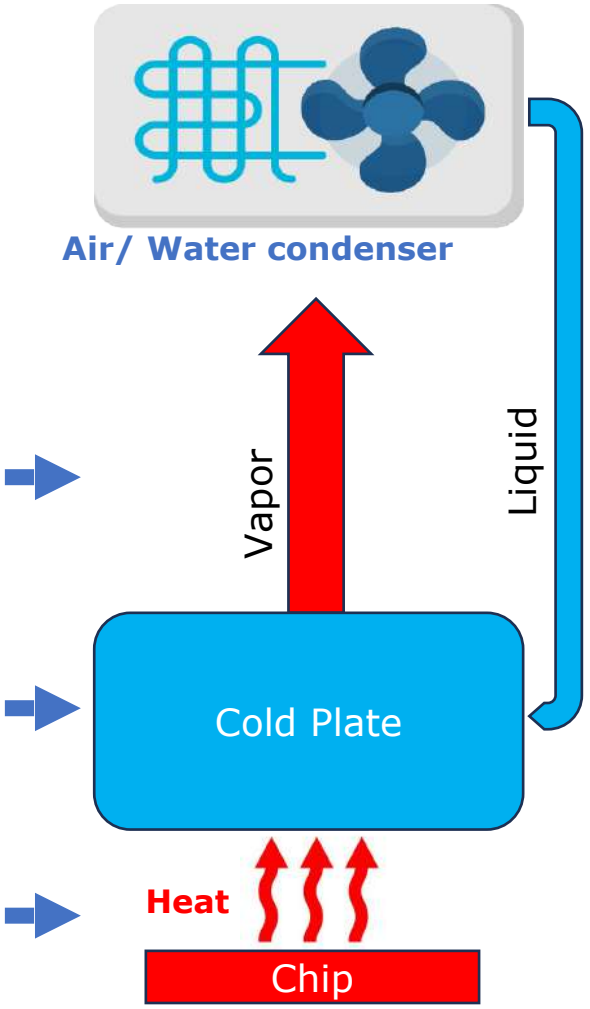
Condenses vapor back into liquid.
Air/water heat rejection

Waterless Heat Transfer Fluid

Non-conductive, non-corrosive
Low GWP, low PFAS

Two phase DLC – Cool by Boiling

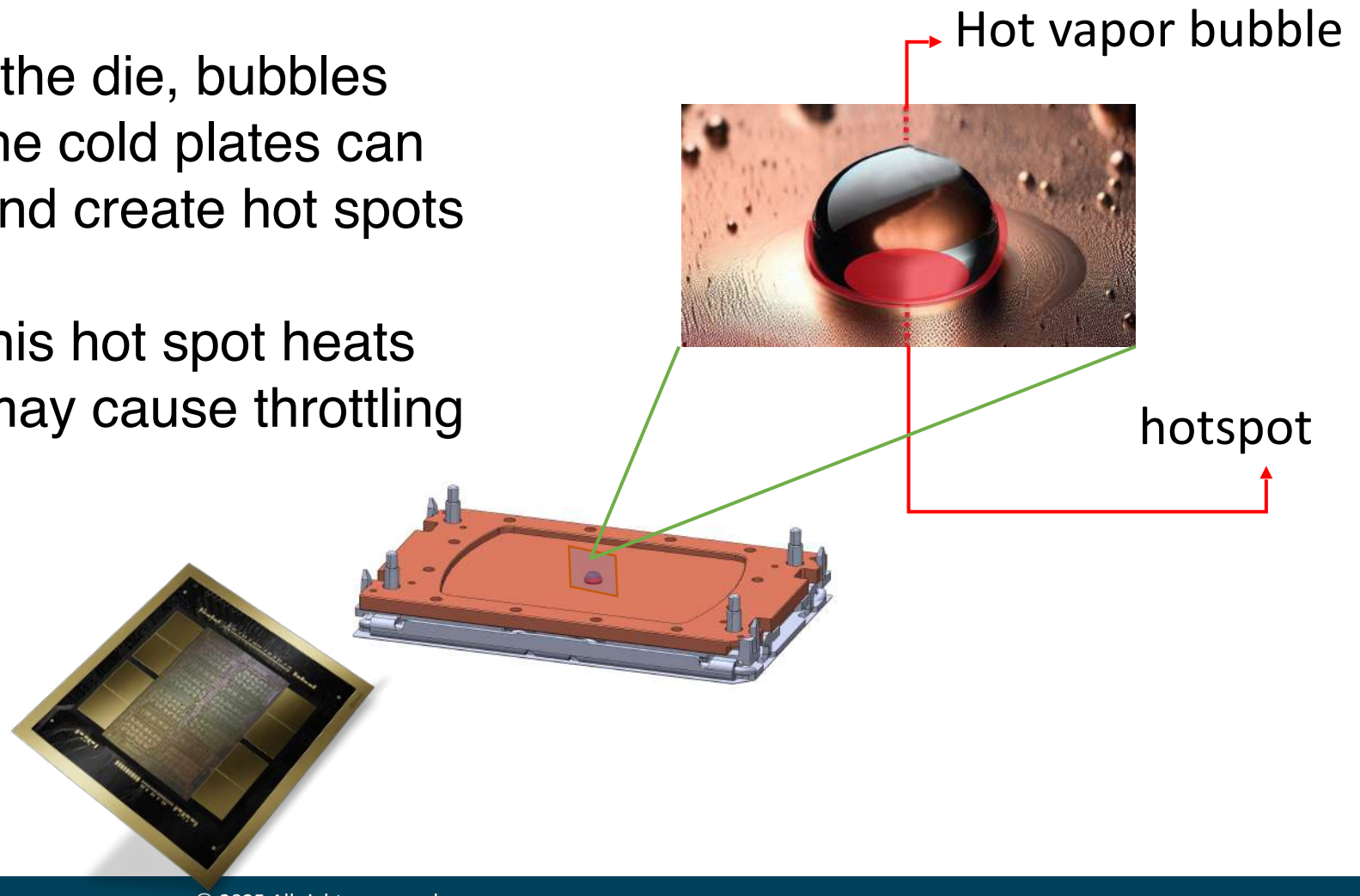
- Fluid boils and turn into vapor
- **Maintaining constant temperature**
- Regardless of intensity of heat source



Two-Phase DLC Solution for High Power

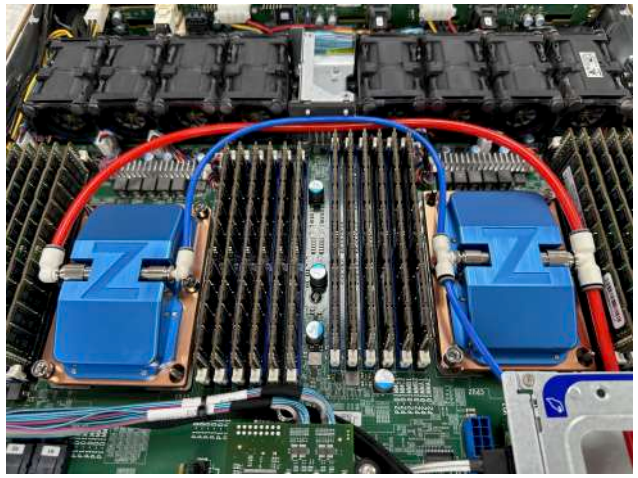
- Major Challenge (Bubbles, Boiling Incipience)

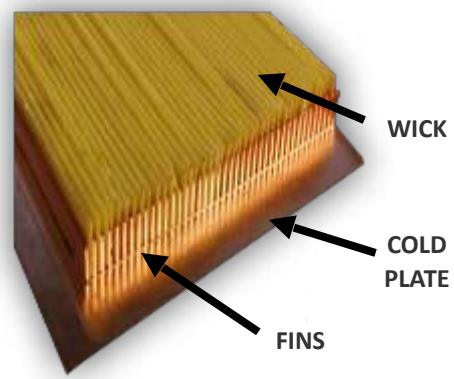
When the liquid boils over the die, bubbles formed on the surface of the cold plates can act as insulating barriers and create hot spots on the die.
When cooling CPU/GPU this hot spot heats 1000s of transistors, and may cause throttling

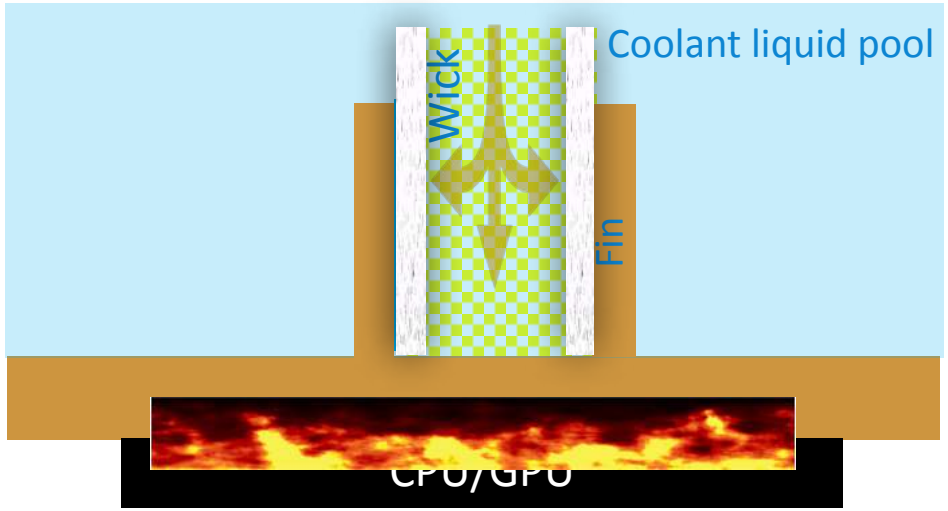


Waterless 2-Phase Cold Plate

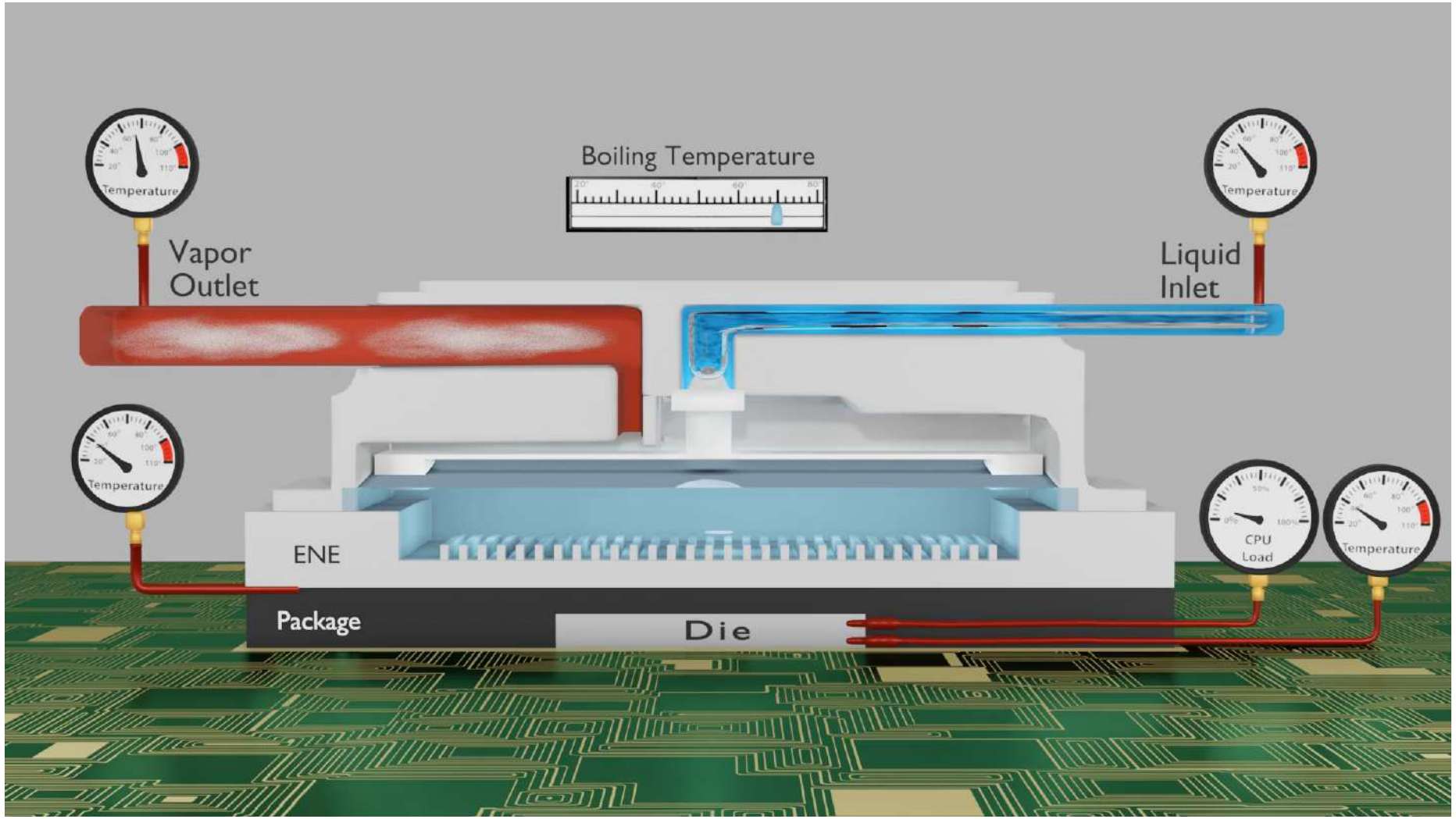
- On-demand liquid cooling of processors up to and above 2800W and over 300 W/cm2 (heat flux)
- Self-regulated pool boiling
- PPUE <1.03
- Qualified by leading processor manufactures
- Compact and simple to install
- Deployed into major server manufacturers







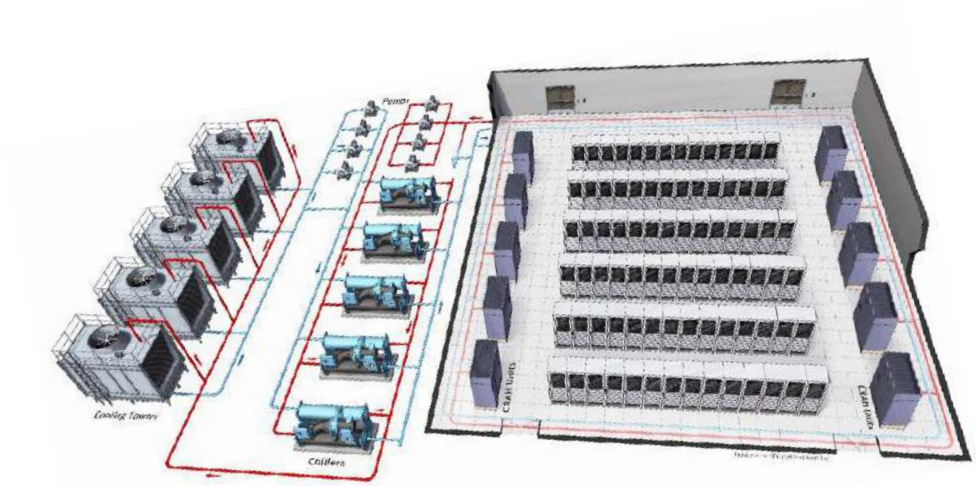
ZC ENE Cold plate



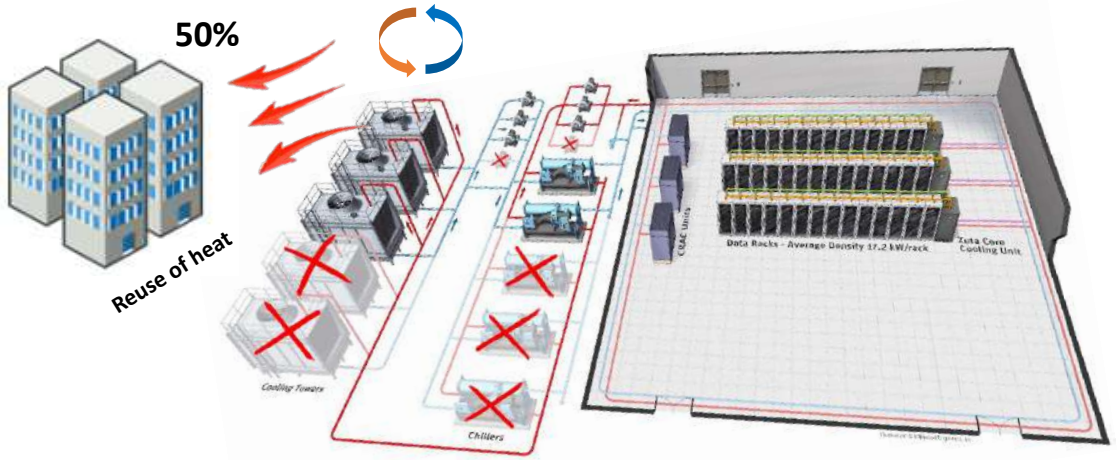
Heat Rejection Unit (HRU)

- Condenses the refrigerant vapor back into liquid refrigerant, ready to be pumped through the system.
- HRU water supports up to 120 kW of total rack power.
  - Facilities' water removes heat.
- HRU air supports up to 20 kW of total rack power.
  - Heat is removed by air.
- < 4 Gallons of Dielectric Fluid
- Fully reusable (20yrs), Recyclable
- Redundancies for 5x9 availability
- Minimal (to no) disruption to the data center
- Sustains 70°C for heat-reuse

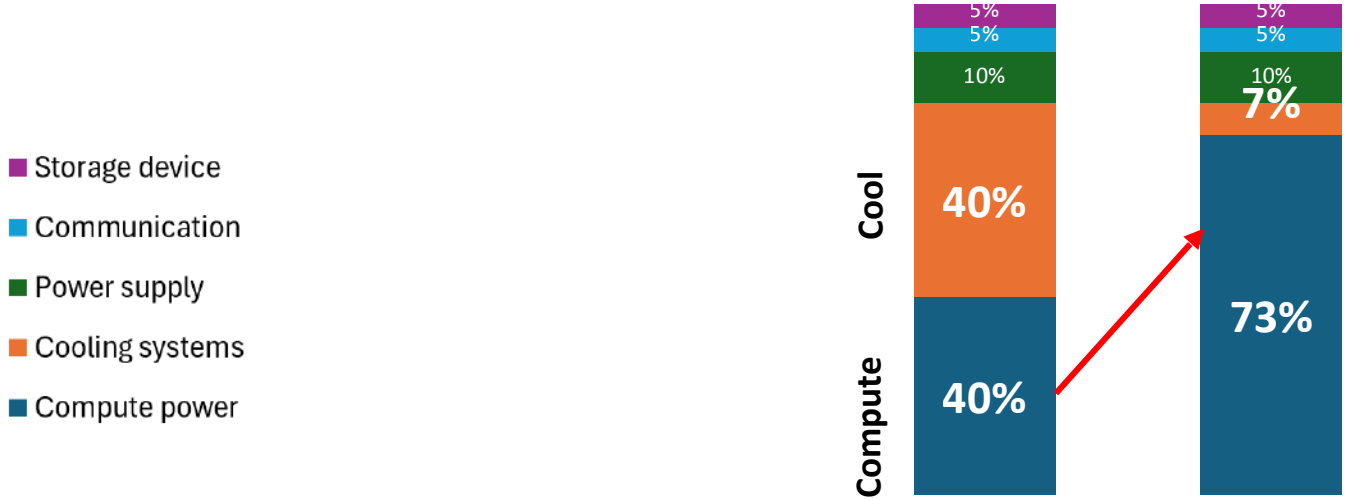
Use Case – Air Cooling vs. ZutaCore®



1w cooling => 1w power



1w cooling => 10w power



1MW Data Center TCO Comparison

Parameter	Air	Two-Phase	Savings
Max Power / Rack	40 KW	100 KW	
Total energy/year	12.6 MWh	9.4 MWh	25%
TCO 10 years (*)	22 M USD	16.6 M USD	5.3 M USD
OPEX	1.9 M USD/year	1.4 M USD/year	0.5M USD/year
CAPEX	2.9 M USD	2.6 M USD	0.3 M USD
Real estate (# of racks)	28	16	43%

(*) TCO calculation may slightly vary from country to country according to the local energy prices and weather

Benefits to the Data Center

1 MORE PERFORMANCE & COMPUTE DENSITY

1. Instant & uniform cooling for the highest performance 2800W (and beyond) TDP processors
2. Achieves more compute density with slimmer AI servers saving 50% more space & 2-3x more power per rack vs. air cooling

2 MORE ENERGY & SUSTAINABILITY

1. Reduces DC energy consumption, enabling PUE of 1.025
2. Enables efficient waste heat reuse across DC and beyond
3. Creates new ways to recover energy from operations
4. Minimizes/eliminates water consumption for extreme WUE

3 MORE OPEX & CAPEX SAVINGS

1. ROI in <2-years (instant for new AI factories)
2. Decrease CAPEX with less/no chillers/CRAC
3. ~$1M saved on 2MW data center annually

Global Ecosystem for Sustainable AI

Silicon Companies

- NVIDIA
- AMD
- Intel

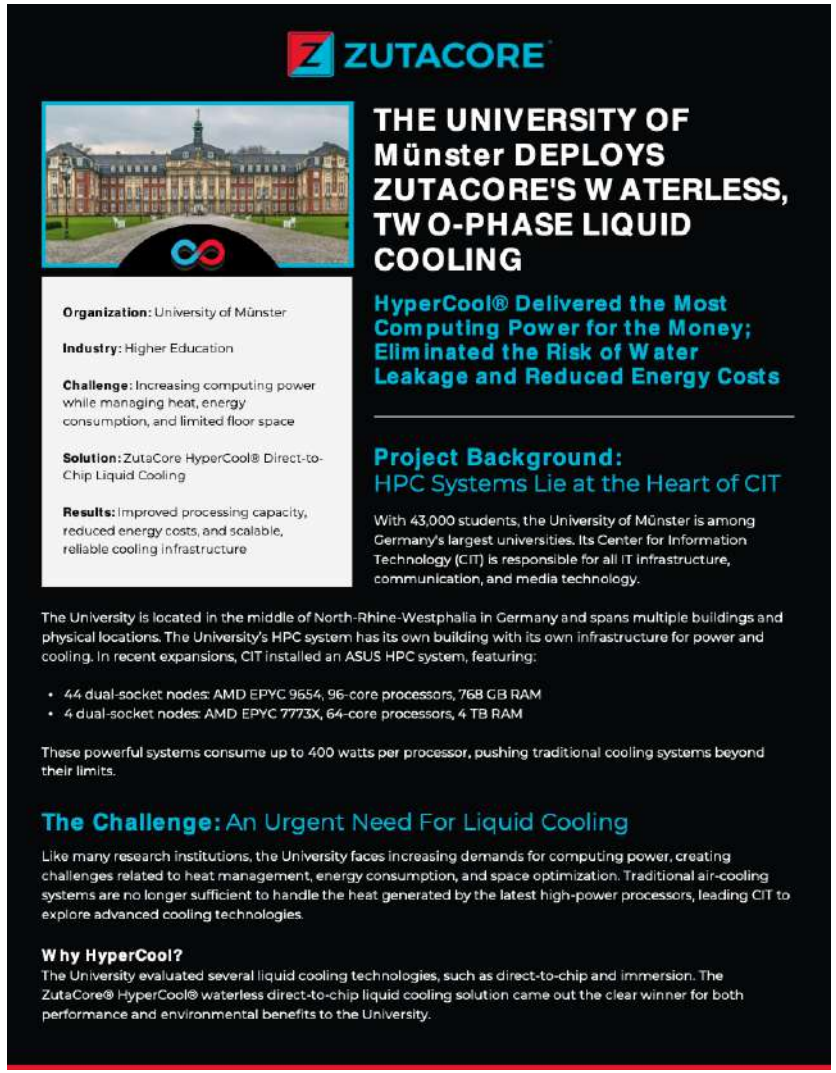
Server OxMs

- AsRockRack
- ASUS
- Compal
- Dell
- Foxconn
- Pegatron
- SuperMicro
- WiWynn

Data Center Integrators

- Boston
- CPI
- MHI
- Park Place
- Unicom
- WWT

Case Study – University of Münster



ZUTACORE

THE UNIVERSITY OF Münster DEPLOYS ZUTACORE'S W ATERLESS, TW O-PHASE LIQUID COOLING

HyperCool® Delivered the Most Computing Power for the Money; Eliminated the Risk of Water Leakage and Reduced Energy Costs

Organization: University of Münster

Industry: Higher Education

Challenge: Increasing computing power while managing heat, energy consumption, and limited floor space

Solution: ZutaCore HyperCool® Direct-to-Chip Liquid Cooling

Results: Improved processing capacity, reduced energy costs, and scalable, reliable cooling infrastructure

Project Background: HPC Systems Lie at the Heart of CIT

With 43,000 students, the University of Münster is among Germany's largest universities. Its Center for Information Technology (CIT) is responsible for all IT infrastructure, communication, and media technology.

The University is located in the middle of North-Rhine-Westphalia in Germany and spans multiple buildings and physical locations. The University's HPC system has its own building with its own infrastructure for power and cooling. In recent expansions, CIT installed an ASUS HPC system, featuring:

- 44 dual-socket nodes: AMD EPYC 9654, 96-core processors, 768 GB RAM
- 4 dual-socket nodes: AMD EPYC 7773X, 64-core processors, 4 TB RAM

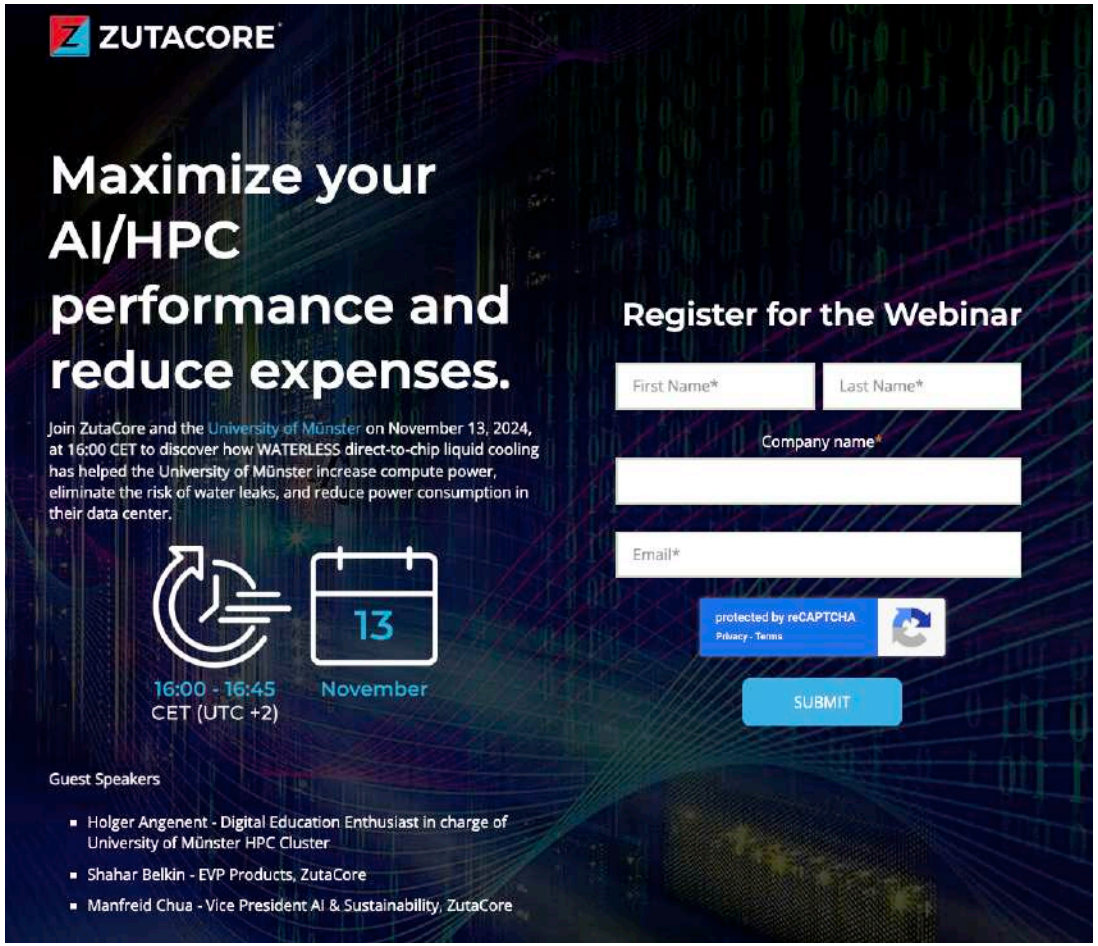
These powerful systems consume up to 400 watts per processor, pushing traditional cooling systems beyond their limits.

The Challenge: An Urgent Need For Liquid Cooling

Like many research institutions, the University faces increasing demands for computing power, creating challenges related to heat management, energy consumption, and space optimization. Traditional air-cooling systems are no longer sufficient to handle the heat generated by the latest high-power processors, leading CIT to explore advanced cooling technologies.

W hy HyperCool?

The University evaluated several liquid cooling technologies, such as direct-to-chip and immersion. The ZutaCore® HyperCool® waterless direct-to-chip liquid cooling solution came out the clear winner for both performance and environmental benefits to the University.



Register to watch the webinar - https://hello.zutacore.com/university-of-munster

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