



MARA™

Advanced Liquid Cooling to Reach Data Center Adjusted PUE<1

NASDAQ:MARA • APRIL 2025 • JIMIL M. SHAH, PH.D. • THERMAL MANAGEMENT EXPO

MARA is a global leader in Digital Asset Compute (“DAC”).

We support the energy transformation by converting clean, stranded, or otherwise underutilized energy into economic value.

Our mission is to build a more sustainable and inclusive future.

NOTE: DIGITAL ASSET COMPUTE IS A PROCESS THAT USES HASHES (I.E., COMPUTATIONAL POWER) TO GENERATE AND SECURE DIGITAL ASSETS SUCH AS BITCOIN



16

DIGITAL ASSET SITES

4

CONTINENTS OF OPERATIONS

1,500 MW

DATA CENTER PORTFOLIO

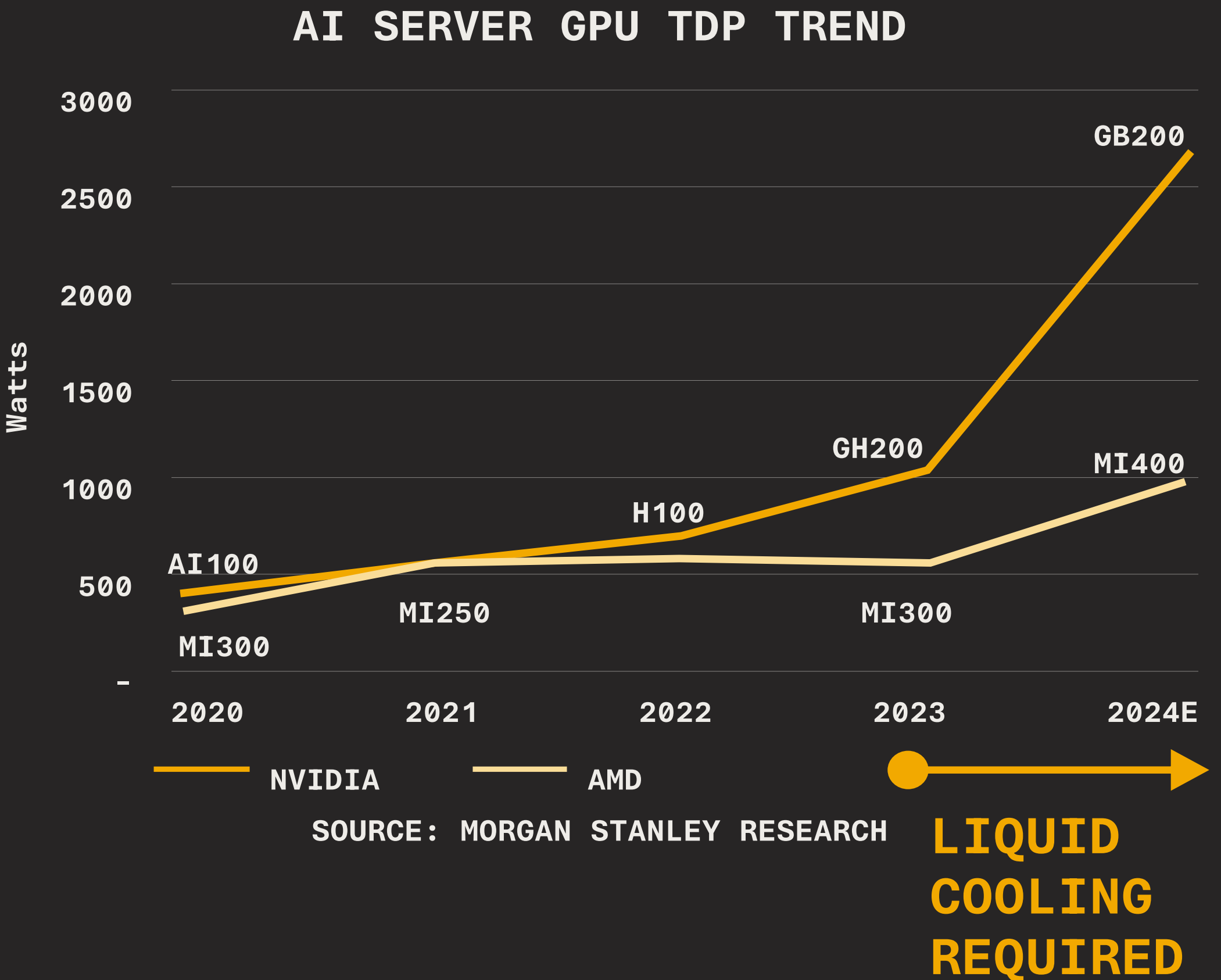
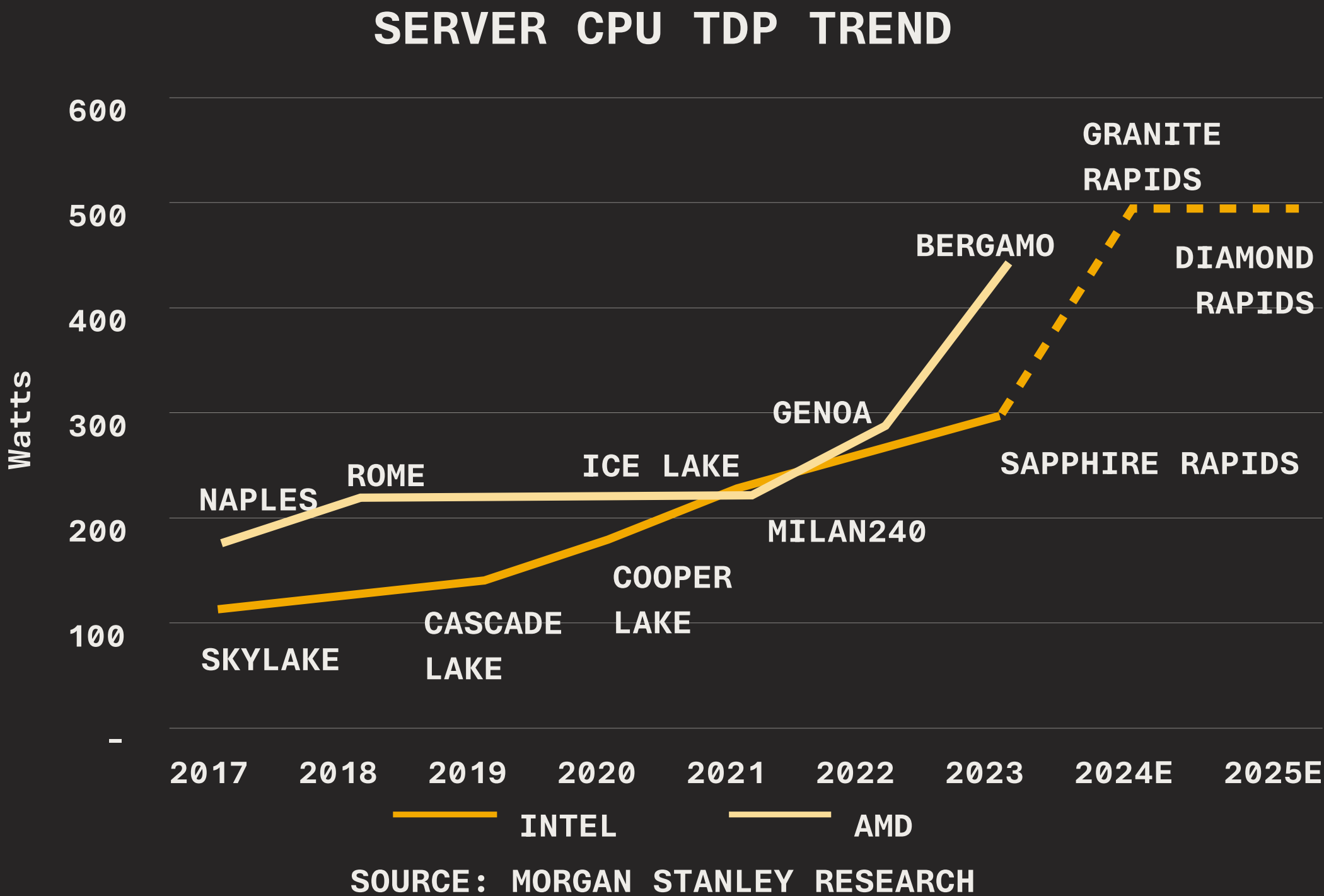
\$6.5 Billion

MARKET CAPITALIZATION

Note: All metrics reflect company data as of November 13, 2024¹

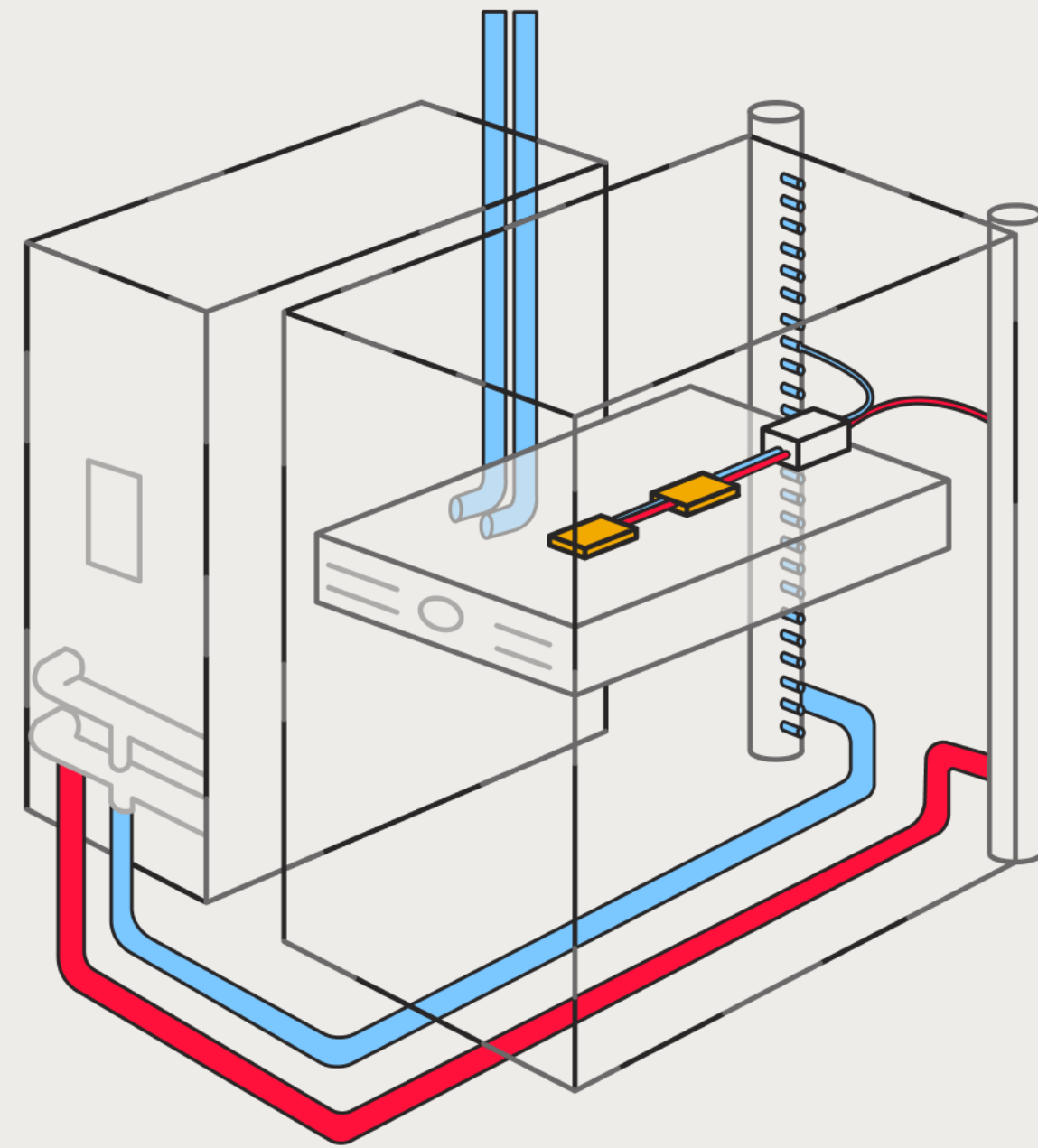
* MARA has established a Joint Steering Committee and framework with the Republic of Kenya but does not yet have an active data center in the country.

AI/HPC data centers of the future need liquid cooling²



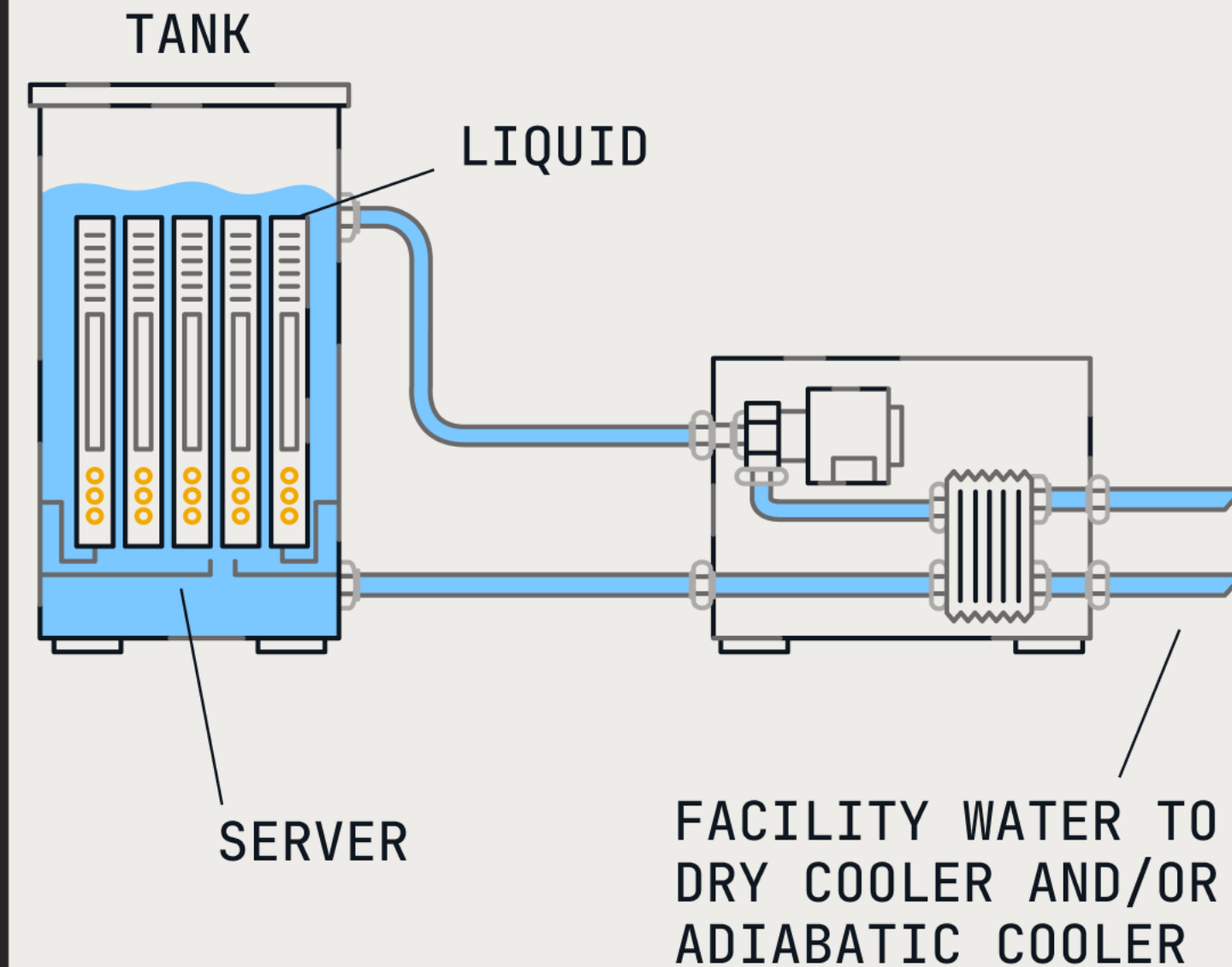
The total addressable market for liquid cooling in Nvidia's GB200 data center systems is projected to reach **\$4.8B** by 2027.

Overview of different liquid cooling methods



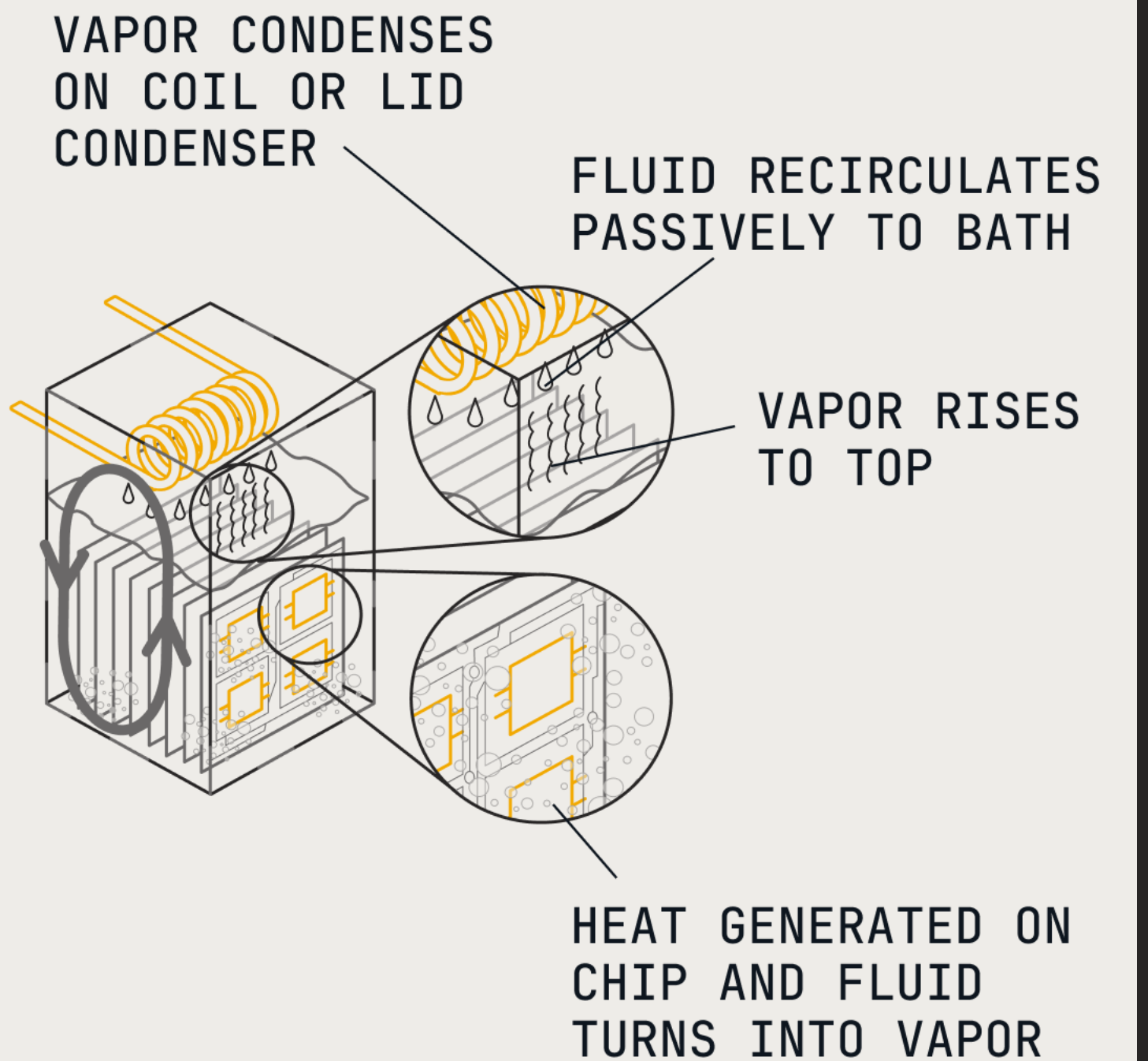
SOURCE: CHILLDYNE³

Direct-to-Chip (DTC)



SOURCE: 3M⁴

Single-Phase Immersion



SOURCE: MORGAN STANLEY RESEARCH, GIGA-BYTE⁵

Two-Phase Immersion (2PIC)

Comparing DTC, single-phase immersion, & 2PIC

FEATURE/COOLING METHOD	AIR COOLING	DIRECT TO CHIP LIQUID COOLING	IMMERSION COOLING
HEAT TRANSFER METHOD	TRANSFERS HEAT THROUGH AIR FLOW	TRANSFERS HEAT THROUGH WATER FLOW, INCLUDING: LIQUID-TO-AIR: HEAT IS DISSIPATED BY A FAN IN THE RACK, AND THEN THE COOLED WATER RECIRCULATES LIQUID-TO-LIQUID: HEAT IS EXCHANGED IN A CHILLER OUTSIDE THE RACK, AND THEN THE COOLED WATER RECIRCULATES	TRANSFERS HEAT THROUGH SPECIAL LIQUID, INCLUDING: SINGLE-PHASE: HEAT IS DISSIPATED BY THE LIQUID, AND THEN CDU COOLS THE LIQUID TO RECIRCULATE TWO-PHASE: USE LIQUID WITH A LOW BOILING POINT WHICH REMOVES THE HEAT THROUGH THE PHASE PROCESS OF TRANSITIONING FROM A LIQUID TO GAS
HEAT TRANSFER COEFFICIENT RANGE	500-1000W	800-1500W	1000W+
PUE	1.5-1.7	1.07-1.3	1.02-1.03
PROS	MATURE TECHNOLOGY COST-EFFECTIVE	HIGH HEAT TRANSFER COEFFICIENT LITTLE DIFFERENCE WITH EXISTING DATA CENTER DESIGN	HIGH HEAT TRANSFER COEFFICIENT LOWEST PUE
CONS	LIMITED HEAT TRANSFER COEFFICIENT	POTENTIAL RISK OF FLUID LEAKAGE	DATA CENTER NEEDS TO BE REDESIGNED

SOURCE: MORGAN STANLEY RESEARCH⁶

“Edged Data Centers Celebrates Grand Opening of New Ultra-Efficient, Sustainable Data Center in Atlanta”

HEADLINE FROM MENAFN



Edged cooling systems support up to 70 kW per rack with air cooling and ultra-high densities up to 200 kW with plug and play liquid cooling integration

SUPPORTING 200 KW PER RACK

8 kW/RACK

INDUSTRY AVERAGE
(UPTIME INSTITUTE)

70
kW/RACK

EDGED
(AIR COOLING)

200
kW/RACK

EDGED
(LIQUID COOLING)

MARA 2PIC
1 MW/TANK
2 MW/
CONTAINER

168 MW 80+

CAMPUS CAPACITY

1.15

PORTFOLIO DESIGN PUE

SOURCE: MENAFN

Traditional Data Centers Require Massive Amounts of Water



TRADITIONAL DATA CENTERS CAN CONSUME 5 MILLION GALLONS OF WATER A DAY, ENOUGH TO SUPPLY THOUSANDS OF HOUSEHOLDS/FARMS.⁷

Data center water is often treated with chemicals to prevent corrosion and bacterial growth and isn't fit for:⁸

- Human consumption
- Agricultural use
- Local water cycles

AI Water Demands Add to Water Stress

Water consumed from areas with water scarcity (2023):

- Microsoft: 42%⁹
- Google: 15%¹⁰

The surging demand for data is only just beginning

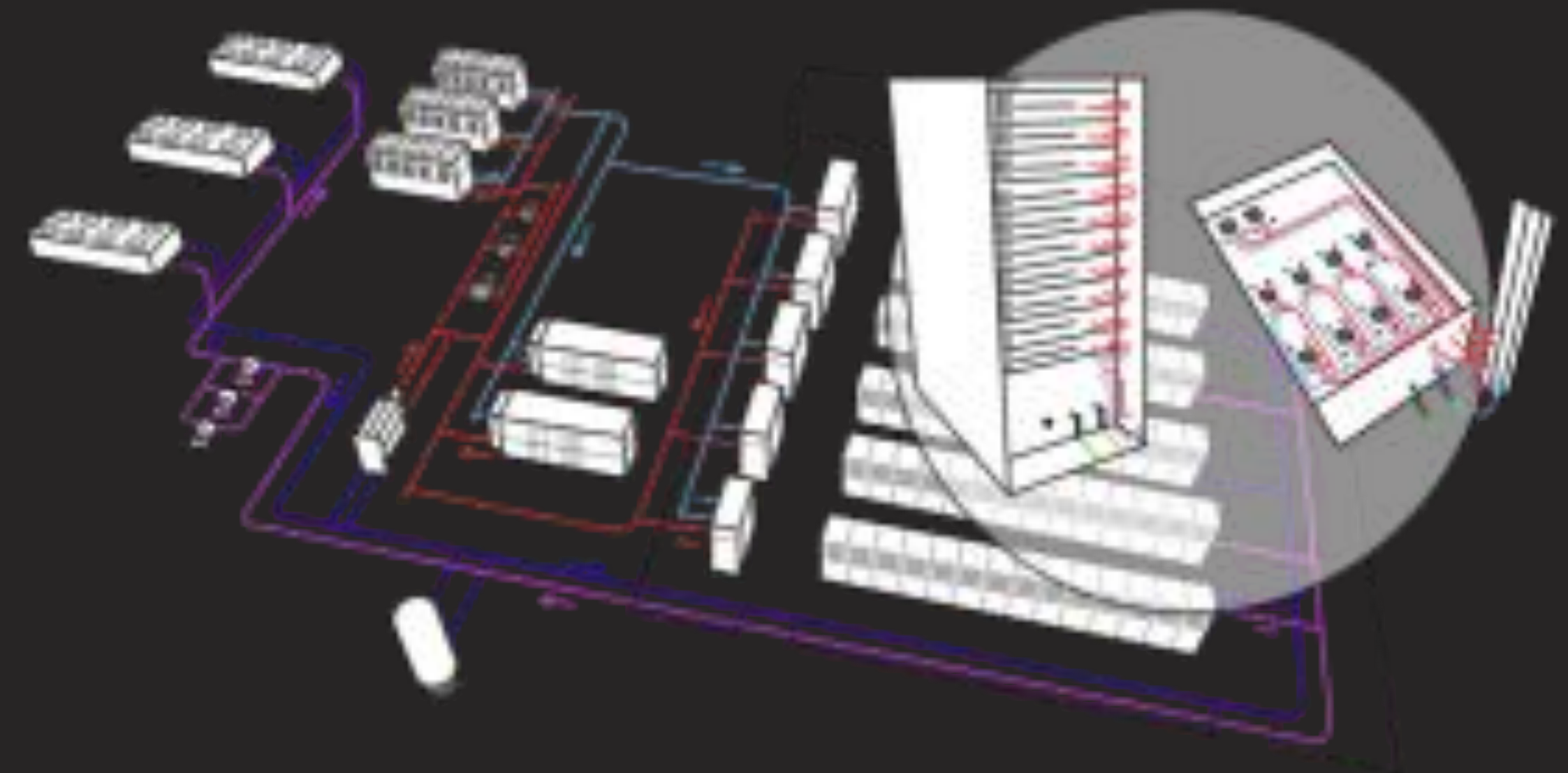
- **Data Center Water Usage:** Data centers are among the top 10 water-consuming industries in the U.S.¹¹
- **Increased Cooling Needs:** Next-gen tech, particularly AI, will increase water use as they generate more heat.
- **Higher Energy Demands:** Neural networks require six times more kilowatts per rack compared to traditional computing.¹²
- **Exponential Scaling:** Large AI algorithms used by major tech companies need 100X the computing power and process significantly more data than simpler machine learning models.¹³

Modular data centers vs. traditional data centers



SOURCE: MARA

Modular Data Center



SOURCE: CONSULTING - SPECIFYING ENGINEER¹⁴

Traditional Data Center

Lack of Renewables Causing Data Center Rejection- Bitcoin Mining Co-Location as a Solution

“Google’s planned Dublin Data center rejected amid energy concerns”¹⁵



- Google’s plan to build a 72,400 square meter data center in Dublin rejected.
- The County Council cited concerns about the strain on the national power grid and insufficient renewable energy.

“Tokyo Grid Operator Mines Bitcoin to Save Renewable Surplus”¹⁶

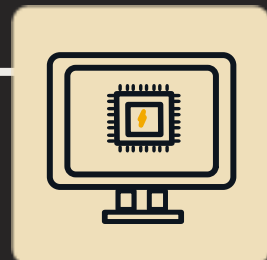
- Agile Energy, a wholly owned subsidiary of a publicly listed Japanese grid operator, is bitcoin mining.
- Japan’s “output control” policy leads renewable energy producers to often curtail operations, leading to wasted green energy.
- In December 2022, Agile Energy partnered with semiconductor designer Triple-1 to source mining chips and set up a pilot data center with 1,300 bitcoin miners and 1,500 kilowatts of capacity.
- Japan's goal of 50% renewable energy by 2050 could result in significant energy waste without a dispatchable energy consumer.

MARA 2PIC large hybrid tank for data centers



COMPACT & MODULAR

Reduces data center space requirements up to 75%.



EXTREME POWER DENSITY

2-4X more power within the same space.*



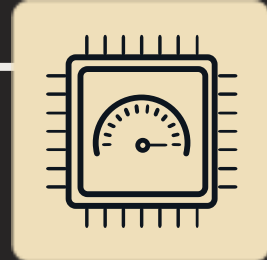
RELIABLE FLUID

<5% annual loss, safe & low environmental impact.



ENERGY EFFICIENT

Up to 60% reduction in cooling overhead.*



BOOST PERFORMANCE

Enables 60% to 100% overclocking for ASIC servers.



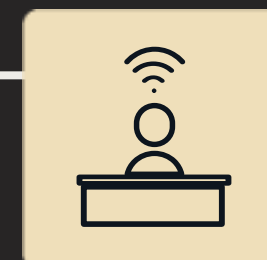
HEAT CAPTURE READY

Efficient high-temperature water output for heating applications.



CROSS-CLIMATE USE

Operate in any environment from 0°C to 50°C ambient temperature.



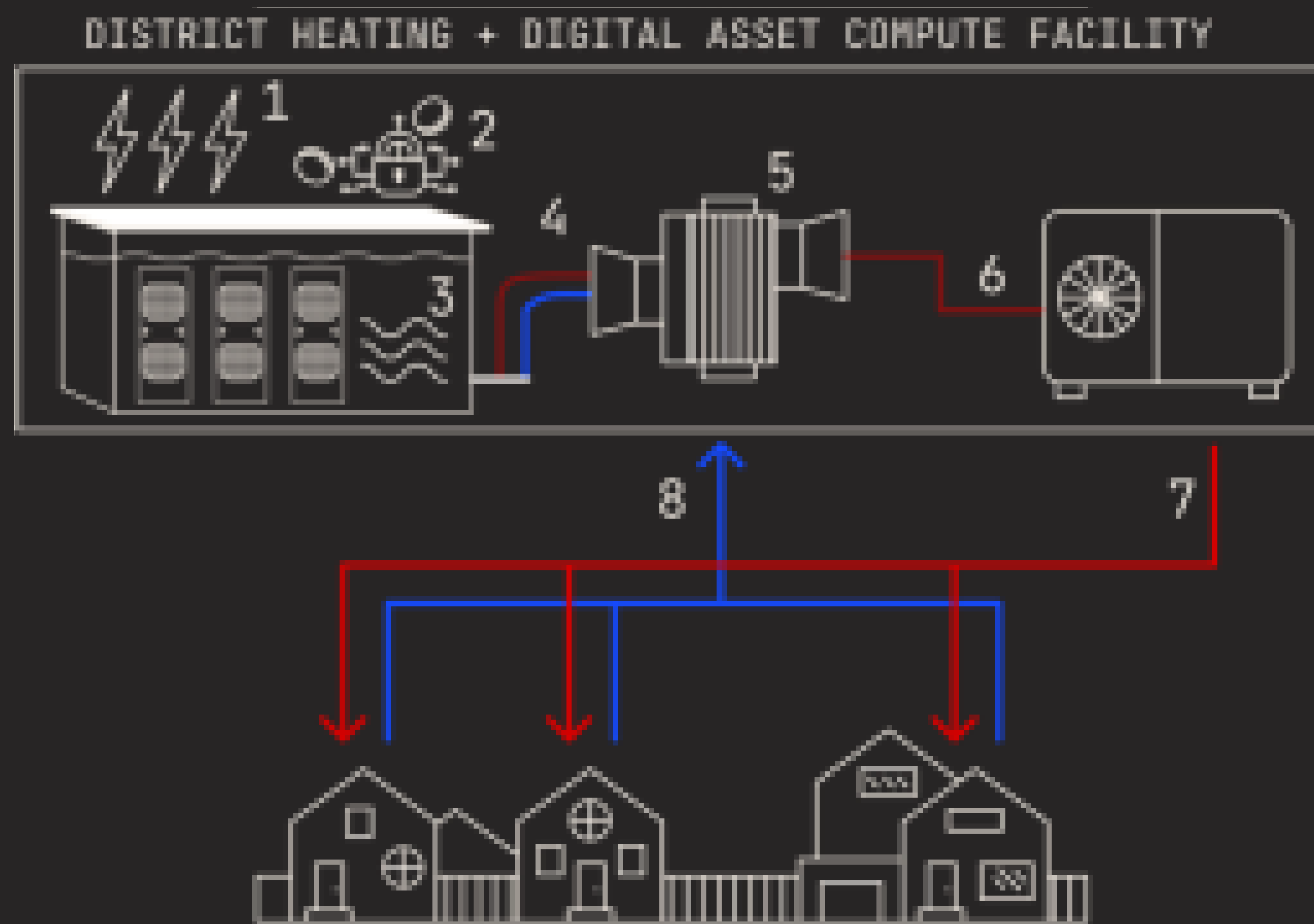
REMOTE MANAGEMENT

Built for unmanned operations, spend less time on maintenance.

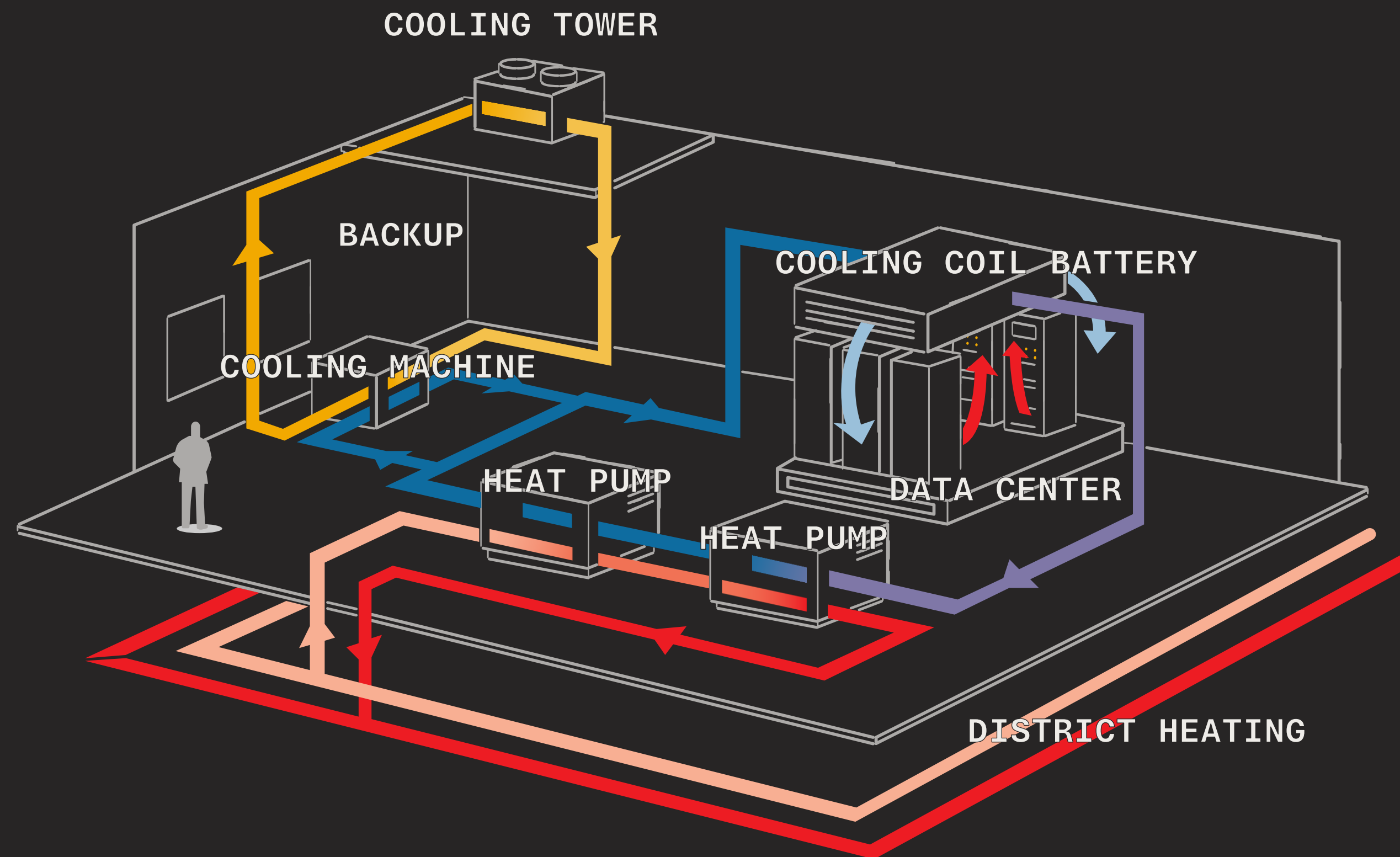
* WHEN COMPARED TO TRADITIONAL AIR-COOLED AND SINGLE-PHASE IMMERSION SETUPS

SOURCE: COMPANY DATA

Leveraging liquid cooling for heat reuse applications¹⁷



Decreasing OPEX and PUE by integrating with district heating systems



SOURCE: IEA¹⁸

$$\text{ADJUSTED PUE} = \frac{(\text{IT} + \text{AC} - \text{DH})}{\text{IT}}$$

IT = IT LOAD

AC = COOLING/HVAC

DH = DISTRICT HEATING

SOURCE: MARA

2PIC + district heating may allow for a PUE less than 1

Thank you!



1. ALL FIGURES ARE AS OF NOVEMBER 2024, AND SOURCED FROM MARA’S INTERNAL COMPANY DATA.
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9. IBID.
10. IBID.
11. SIDDIK, ABU BAKAR, AND ET AL. “THE ENVIRONMENTAL FOOTPRINT OF DATA CENTERS IN THE UNITED STATES.” IOP SCIENCE. ACCESSED SEPTEMBER 10, 2024. [HTTPS://TINYURL.COM/TEPKTX8A](https://tinyurl.com/TEPKTX8A).
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13. VIPRA, JAI. “COMPUTATIONAL POWER AND AI.” AI NOW INSTITUTE, APRIL 19, 2024. [HTTPS://TINYURL.COM/3256DVB6](https://tinyurl.com/3256DVB6).
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15. “GOOGLE’S PLANNED DUBLIN DATA CENTRE REJECTED AMID ENERGY CONCERNS.” ENERGY CENTRAL, SEPTEMBER 2, 2024. [HTTPS://TINYURL.COM/BDCS57UN](https://tinyurl.com/BDCS57UN).
16. “TOKYO GRID OPERATOR MINES BITCOIN TO SAVE RENEWABLE SURPLUS.” THEMINERMAG, SEPTEMBER 8, 2024. [HTTPS://TINYURL.COM/48FSB2V8](https://tinyurl.com/48FSB2V8).
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18. IEA. “HEAT PUMPS IN DISTRICT HEATING AND COOLING SYSTEMS - ANALYSIS.” IEA, NOVEMBER 7, 2020. [HTTPS://TINYURL.COM/3EWXSRM5](https://tinyurl.com/3EWXSRM5).