DATA CENTER THERMAL MANAGEMENT INDUSTRY OVERVIEW

January 2026

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01 Accelerated Growth of Data Center Cooling in the AI Era

Investments in Global Cloud Infrastructure and AI-Related R&D

Hyperscalers and enterprises fuel major investments

Company	CY25 Capex Beginning of 2024	CY25 Capex Pre-4Q Earnings	Current CY25 Capex	% Change vs. Beginning of 2024
Amazon	$61.0B	$88.9B	$89.1B	46%
Microsoft	$46.3B	$64.9B	$66.3B	43%
Google	$38.6B	$61.0B	$75.0B	94%
Meta	$36.2B	$55.6B	$61.2B	69%
Oracle	$9.4B	$15.0B	$15.0B	60%
Apple	$12.0B	$12.6B	$12.7B	6%

53%
Median

> *Microsoft CEO Satya Nadella reaffirmed his plan to spend **$80 billion** on AI data centres in 2025, mostly in connection with its OpenAI partnership and cloud computing division. The company had around **$50 billion** in total capital expenditures in 2024.*

Nasdaq News on Microsoft's commitment to AI data center spend

> *We anticipate our full year 2025 capital expenditure...will be in the range of $64-72 billion, increased from out prior outlook of $60 billion to $65 billion. This updated outlook reflects additional data center investments to support our artificial intelligence efforts as well as an increase in the expected cost of infrastructure hardware.*

Susan Li
Meta CFO

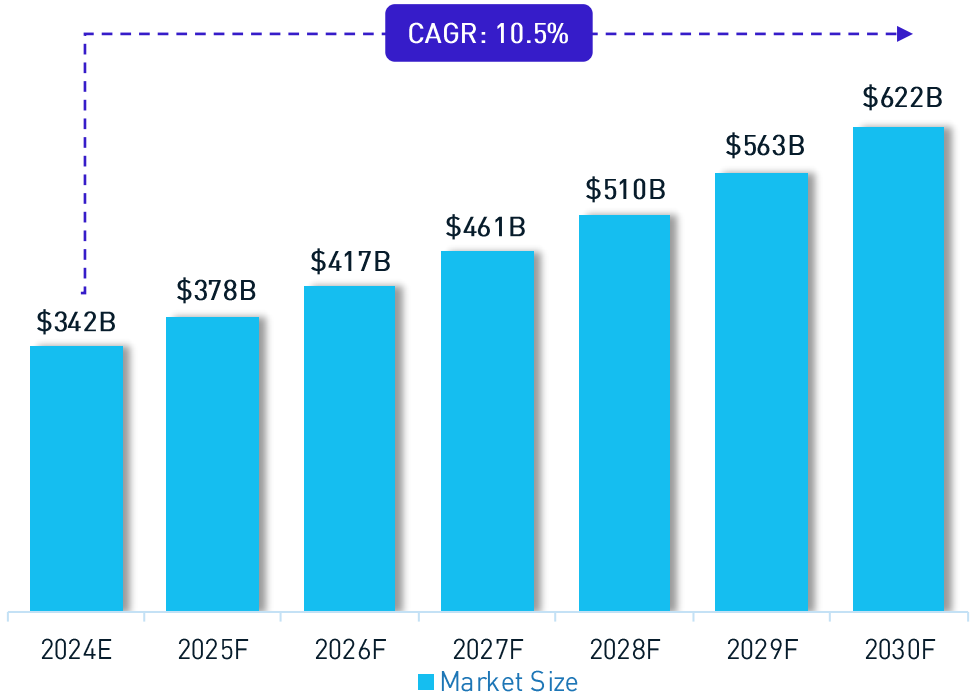
> *Capital investments were $26.3 billion in the fourth quarter, and we think that run rate will be reasonably representative of our 2025 capital investment rate. Similar to 2024, the majority of the spend will be to support the growing need for technology infrastructure, supporting demand for our AI Services as well as tech infrastructure.*

Brian T. Olsavsky,
Amazon Sr. VP and CFO

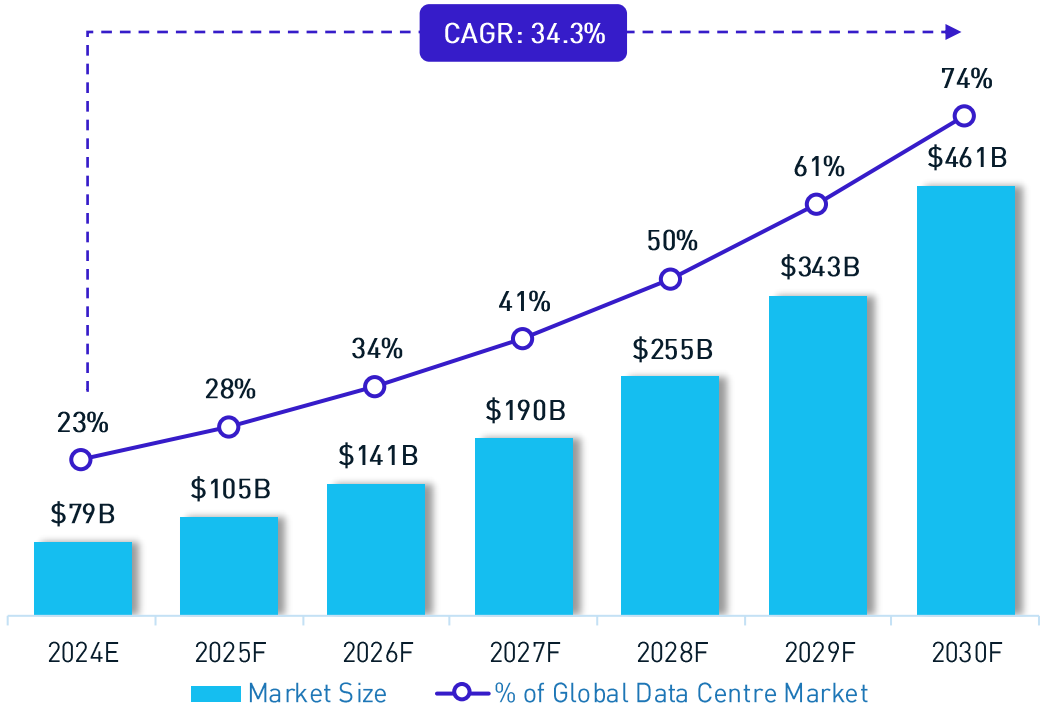
01 Data Center Market

Propelled by AI demand

Data Center Market is Growing at an Accelerated Pace



AI Data Center Market is Expected to Grow by 6x



AI-driven workloads are transforming the data center landscape, propelling power densities in some racks from under 15 kW to 80–120 kW and accelerating adoption of advanced cooling and high-performance infrastructure.

SOURCE: Grand View Research; MarketsandMarkets

01 The AI Revolution

Is only just beginning

Hyperscalers are Aggressively Spending Capital

Capital Spending and Growth (CY2024-CY2026E)

$20B
26%
amazon

$17B
32%
Microsoft

$13B
25%
Google

$4B
40%
ORACLE

Cumulative Capital Spending
$54B

Massive AI Power Demand Forecast

19% in **2028**
Share of AI in data power demand in 2028

160% in **2030**
Increase in data center power demand by 2030

Large Players Continue to Invest in AI

SoftBank

*"Tokyo-based SoftBank will dedicate **$100B** to US ventures over the next four years – double a similar commitment announced in December 2016 heading into Trump's first presidential team"*

- Forbes, December 16, 2024

CoreWeave

*"CoreWeave, the provider of data center technology and services for AI companies, has signed a five-year deal with OpenAI valued at **$11.9B**, according to two people with knowledge of the matter"*

- CNBC, March 10, 2025

NEBIUS

*"Nebius, an AI infrasctructure company, today announced the launch of a new GPU cluster in Paris, as part of the company's plans to invest more than **$1B** by mid-2025 in AI infrastructure in Europe"*

- Company website, September 25, 2024

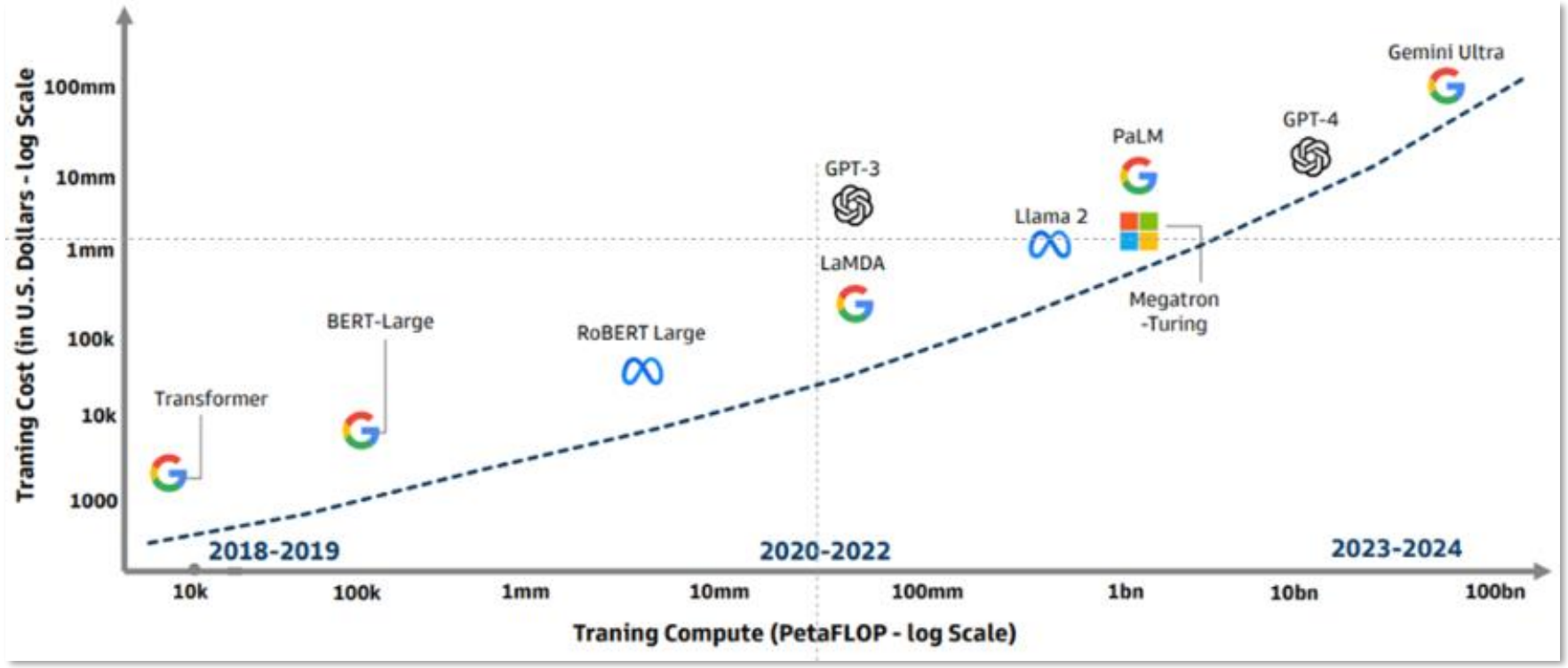
SOURCE: Factset

01

Training Cost of AI Models

Each AI generation trains on exponentially large datasets and parameters

Estimated Training Costs and Compute of Selected AI Models

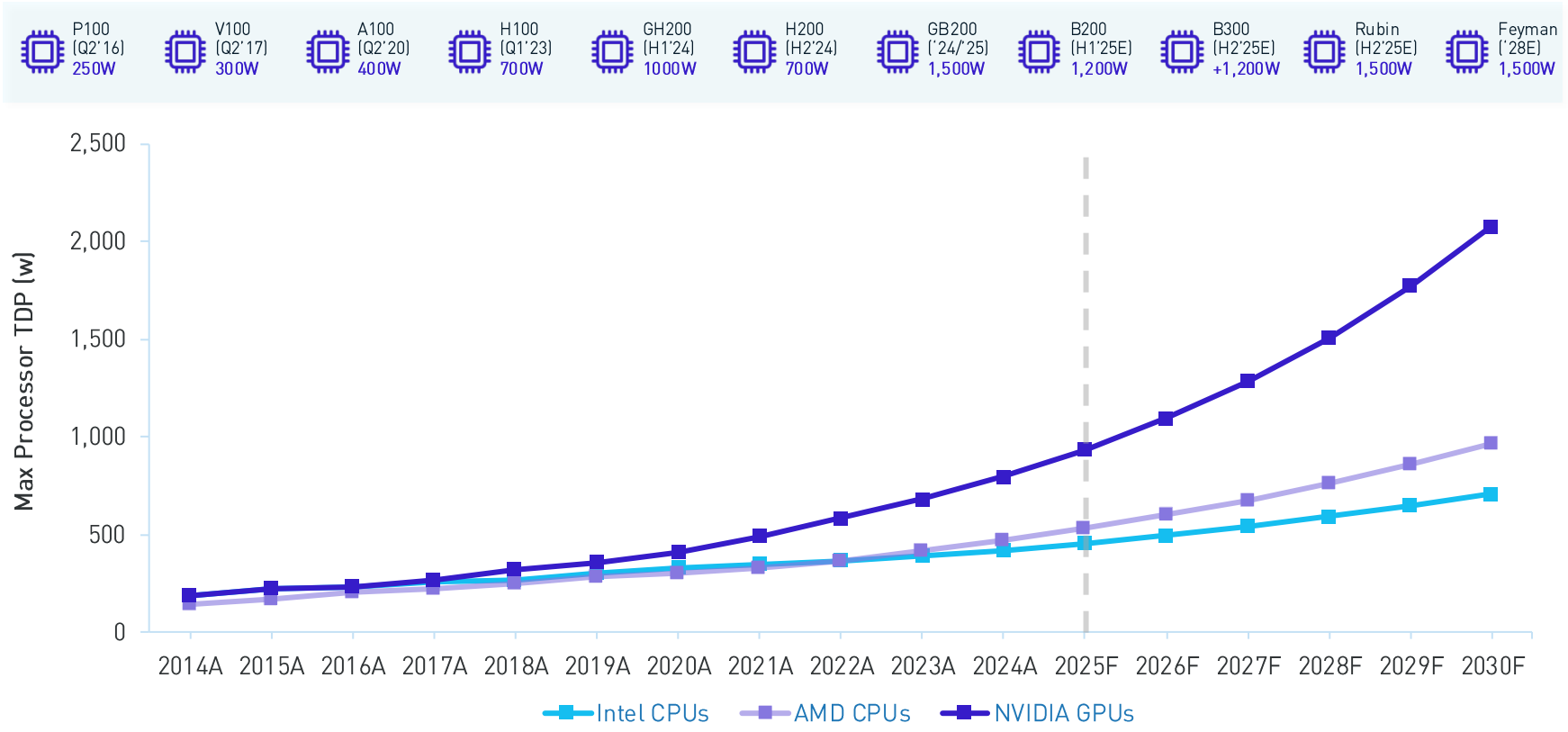


- Modern AI models like Gemini Ultra and GPT-4 use advanced techniques such as multi-modal reasoning, making them much more costly to train
- Training these models requires huge investments in specialized hardware and running thousands of powerful computers all at once

SOURCE: Stanford University

01 Rise in Computational Needs

Generation of Processors and Respective TDP[1], W

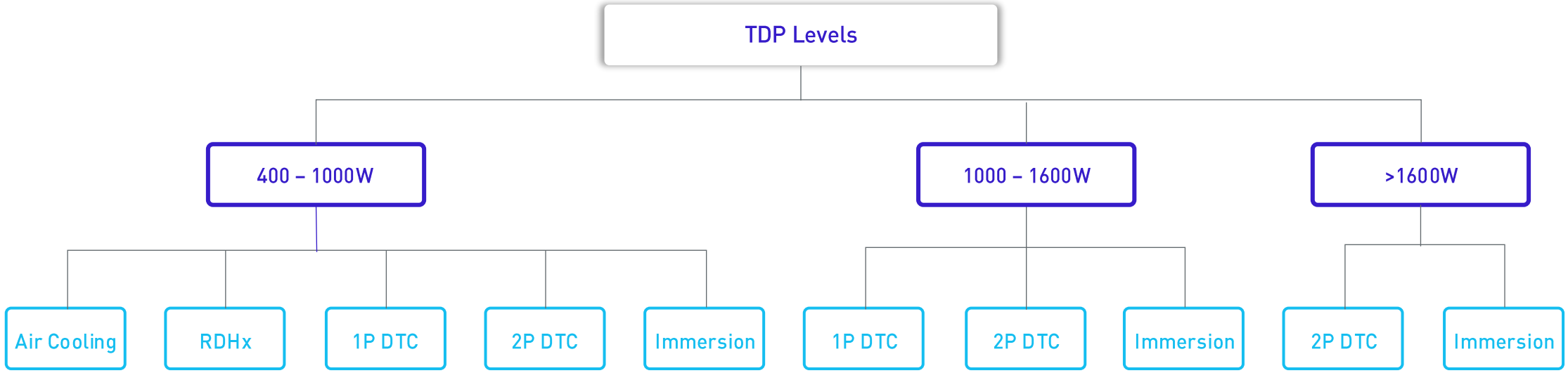


- The maximum power draw of leading GPUs has jumped sixfold since 2019, and cutting-edge AI GPUs could reach up to 2,000W TDP by 2030
- CPU and GPU power density increases are accelerating, with next-generation chips from NVIDIA, AMD, and Intel expected to routinely exceed 500–1,500W, demanding new infrastructure investments

SOURCE: Company Filings

01 Optimum Liquid Cooling Selection

Technology is dictated by the TDP levels



- Direct-to-chip liquid and immersion cooling are recommended for TDP above 400W
- As TDP increases past 1600W, existing cooling may be ineffective, requiring even novel solution

SOURCE: Industry white papers

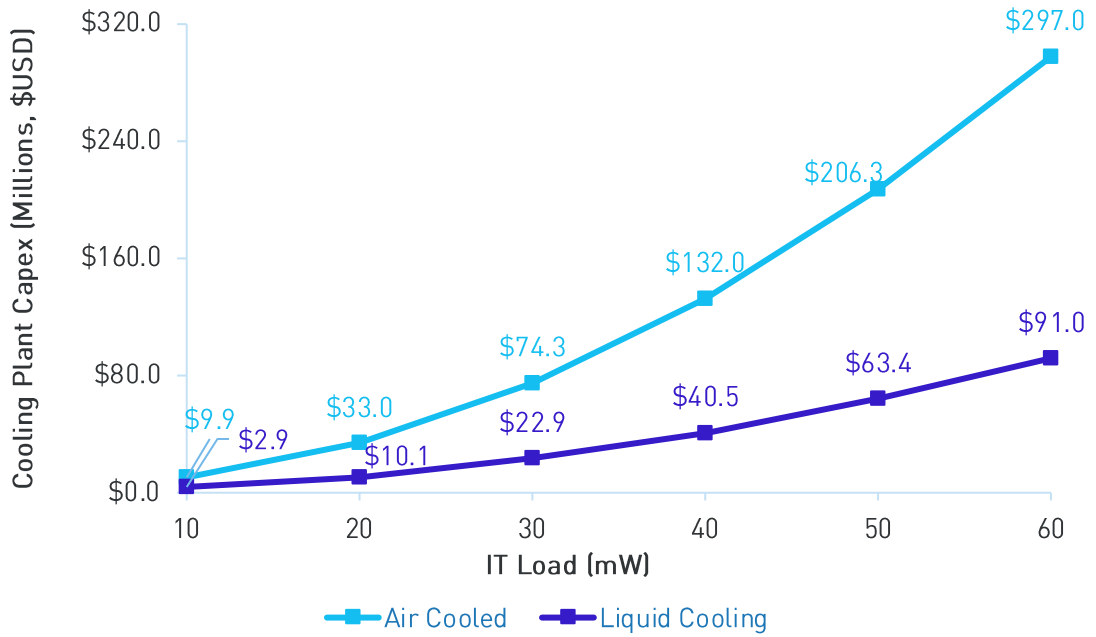
RDHx: Rear Door Heat Exchanger is a liquid-cooled heat exchanger mounted on the rear door of a server rack that removes heat beforeit enters the data center, improving cooling efficiency.
1P (Single-phase cooling): A cooling method where the fluid always stays liquid and does not change phase during heat transfer.
2P (Two-phase cooling): A cooling method where the fluid changes from liquid to vapor (boils) and back again to remove heat more efficiently.

02 Rising Heat Pressures Fuel Demand for Liquid Cooling

02 Capex Trends & Total Cost of Ownership (TCO) Implications

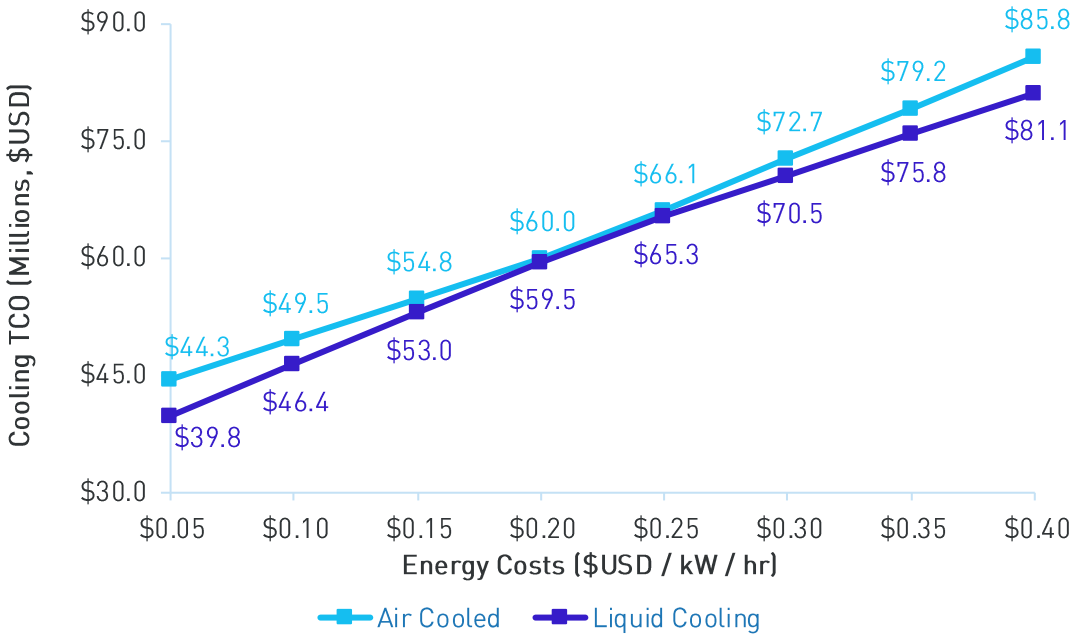
High-performance AI workloads and reduced Capex

Annual Estimated Effect of IT Load Increases on Cooling Plant Capex ($)



All else being equal, cooling plant capex increases significantly in air-cooled solutions to support the same IT load due to the need for shell expansion

Annual Energy Cost Impact of Cooling TCO ($)



As energy costs surpass $0.2 per kWh, liquid cooling becomes a more energy efficient option in cloud deployments

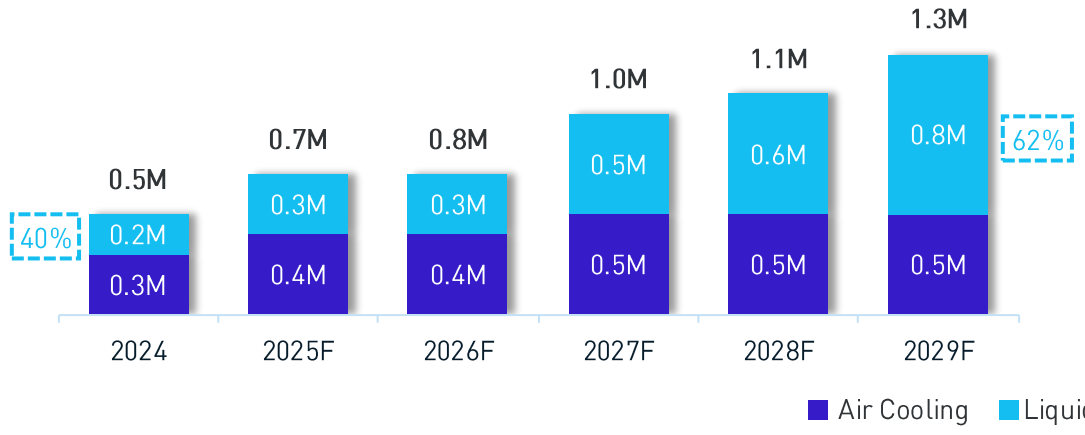
In a world with power constraints, customers are focused on making sure that every watt is allocated to revenue generating activities

SOURCE: Schneider Electric

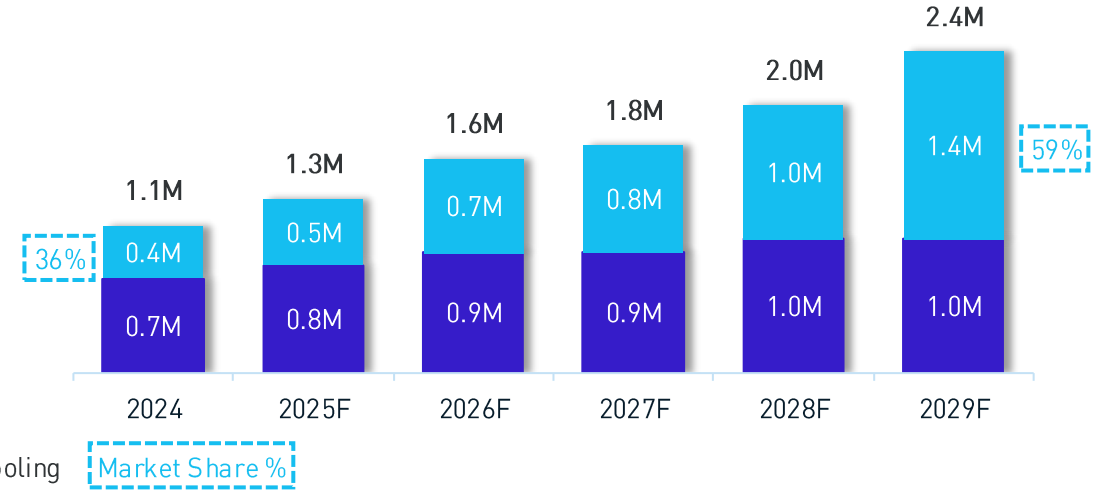
02 High Performance Computing (HPC) & AI Server Shipments

Liquid cooling adoption in HPC and AI servers

HPC Server Shipments – Air vs. Liquid Cooling (Units)



AI Server Shipments – Air vs. Liquid Cooling (Units)



High-Performance Computing (HPC) Servers

- Designed for scientific research, simulations, and data analysis requiring precise calculations across large datasets
- GPU-to-CPU ratios, typically ranging from 0-4 GPUs per dual-socket server, as many scientific workloads remain heavily CPU-dependent

Artificial Intelligence (AI) Servers

- Built for training and deploying machine learning models
- Systems are characterized by their substantial investment in GPU acceleration, commonly featuring 4-8 GPUs per 1-2 CPU socket

SOURCE: Future Market Insights; Grand View Research; TechSci Research

02 Digital Economy

Serving four of the most critical digital industries

	Data Center	Edge / 5G	High Performance Computing	Crypto Solutions
	– **Serving:** Mission-critical infrastructure powering cloud, enterprise, hyperscale, and colocation services – **Cooling Challenge:** Growing rack densities, rising power consumption, and sustainability pressure. Air cooling is hitting thermal limits as chips exceed 500W+ – **Market Size (CAGR):** $5.4B (21.6%)	– **Serving:** Distributed computing at the network edge, supporting IoT, autonomous vehicles, smart cities, and low-latency 5G applications – **Cooling Challenge:** Space-constrained, harsh environments with limited access to traditional cooling – **Market Size (CAGR):** $1.4B (11.2%)	– **Serving:** Powering advanced workloads like AI, machine learning, weather modelling, scientific research, and financial simulations – **Cooling Challenge:** HPC clusters run compute-intensive workloads with extreme densities – **Market Size (CAGR):** $1.2B (7-10%)	– **Serving:** Cryptocurrency mining and blockchain operations running 24/7, often in remote ocations – **Cooling Challenge:** Mining hardware generates extreme heat, impacting efficiency and hardware life span. Air cooling is costly and inefficient, especially in hot climates – **Market Size (CAGR):** $0.3B (3.5%)
Use Cases	Hyperscale Cloud Platforms	5G & Industrial	High Lux Chip R&D	Crypto Mining
	Colocation & Enterprise	Telecom & Telco Edge	OEM, Fluid Testing, and Qualification	Brick & Motor Blockchain
	Brownfield Colocation & On-Premise	Regional Edge, ISPs and CDNs	AI, ML, & Cyber Security	Containerized & Modular DCs
	Edge Computing	AI, ML & Cyber Security	Virtualization & IT Consolidation	
	Generative AI	Point of Sale (PoS)	R&D and Computational Modelling	

SOURCE: Grand View Research; Data Bridge; Intersect360 Research; Intel Market

03 The Future of Liquid Cooling for Data Centers

03 Immersion and Direct-to-chip (DTC) Cooling is the Future

Optimized performance & efficiency in computing

Immersion Cooling		DTC Cooling
Immersion can offer **uniform cooling across all heat generating components** and capture greater total amount of waste heat	**Waste Heat and Deployment**	DTC cooling integrates **more seamlessly with existing server hardware and rack architecture, avoiding need for specialized, immersion-compatible equipment** and enabling faster deployment
Immersion can offer **greater potential for reducing the energy overhead** associated with cooling the entire data center IT workload since the need of energy-intensive server fans and traditional room-level will be eliminated	**Energy Cost and Efficiency**	DTC enables **targeted, higher cooling efficiency at the chip level** and better enables heat capture while minimizing unnecessary fluid coverage or exposure
Immersion can enable **significantly more computing power due to its ability to address higher thermal design power**	**Computing, Maintenance, and Serviceability**	DTC enables **easy maintenance** and **fast serviceability (units unplugged without draining fluids)**

03 Key Players Driving Immersion and DTC Cooling Solutions

Breakthrough liquid cooling technology

Immersion Cooling		DTC Cooling	
Asperitas IMMERSED COMPUTING®	DCX	Asetek	CoolIT systems™
FUJITSU	GRC GREEN REVOLUTION COOLING The Immersion Cooling Authority	ICEOTOPE®	motivair™ by Schneider Electric
liquidstack°	submer	VERTIV™	ZUTACORE

04 Investment Trends and Valuation Comparables in Liquid Cooling

04 Investments in Cooling Tech(1/2)

Target	Investors	Capital Deployed ($M)	Technology
Nautilus Data Technologies	Allectus, Emerson, Keppel, Orion, Mancal Group	267	DTC
Submer	Big Sur, Horizon 2020, M&G, Mundi, Noorsken, Plug & Play	131	Immersion
TAS Energy	Comfort Systems	116	DTC & Immersion
Iceotope	Aster, Innovative UK, nVent, Ombu Group, Pavilion Capital	78	DTC
Qarnot	Accelerace, ADEME, Banque des Territories, DATA4, Demeter, EIT Digital, ENGIE, Societe Generale	55	DTC
LiquidStack	Tiger Global, Trane Technologies, Wiwynn	45	DTC & Immersion
Accelsius	Ascent X, Innventure, Tri State, Western Technology Inv	42	DTC
Green Revolution Cooling	Eneos Innovation, HTS Engineering, SK Enmove	42	Immersion

~$1B+ has been deployed by VC and PE investors towards Cooling Tech R&D in the last couple of years

SOURCE: Pitchbook, Capital IQ, Factset, Company Filings

04 Investments in Cooling Tech(2/2)

Target	Investors	Capital Deployed ($M)	Technology
ZutaCore	Carrier Ventures, DIVEdigital LIP, Mitsubishi, NextLeap	40	DTC
LiquidCool Solutions	Capital Midwest, Cornerstone, FUND4SE, StarTec, Wells Fargo	28	DTC & Immersion
ECL	Bachmanity Capital, Hyperwise Ventures, Molex Ventures	20	DTC
Cloud&Heat Technologies	ETF Partners, Inven Capital, Plug & Play, VNG Innovation	17	DTC
Air_2O	EREN Groupe	14	Hybrid
SkyCool Systems	Arpa-E, BlueSky, CalSEED, D3 Jubilee	9	Hybrid
Chilldyne	Arpa-E, Flometrics	5	DTC
Asperitas	Horizon 2020, PDENH, Shell Ventures, Start Green Capital	2	Immersion

~$1B+ has been deployed by VC and PE investors towards Cooling Tech R&D in the last couple of years

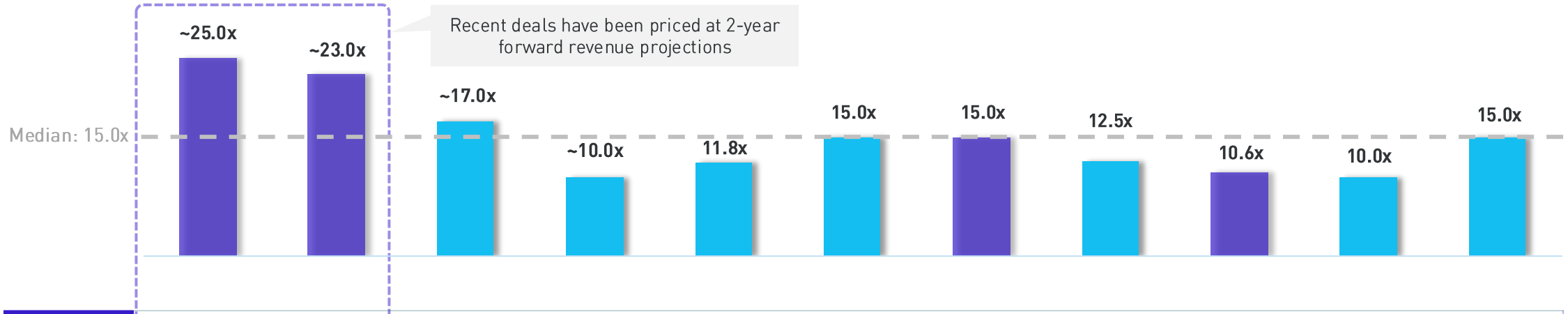
SOURCE: Pitchbook, Capital IQ, Factset, Company Filings

Private M&A Transactions Valuation Metrics

Target	Acquirer	Date	Transaction Size	Revenue Multiples
Motivair	Schneider Electric	Oct-24	~$1,133M	~25.0x
CoolIT Systems	KKR	May-23	~$305M	~23.0x
Viessmann	Carrier Global	Apr-23	~$13,165M	~17.0x
Copeland	Blackstone	Oct-22	~$14,000M	~10.0x
Centrotec	Ariston Group	Sep-22	$1,000M	~11.8x
DiversiTech	Partners Group	Nov-21	$2,200M	~15.0x
BASX Solutions	AAON	Nov-21	$180M	~15.0x
Nortek Air Solutions	Madison Industries	Apr-21	$3,625M	~12.5x
Silent-Aire	Johnson Controls	Apr-21	$870M	~10.6x
TRUaire	CSW Industrials	Nov-20	$360M	~10.0x
Service Logic	Leonard Green & Partners	Nov-20	>1,000M	~15.0x
			Median	~15.0x

SOURCE: Pitchbook, Capital IQ, Factset, Company Filings

04 Private M&A Transactions Valuation Metrics



Target	motivair	CoolIT systems	VIESMANN	COPELAND	CENTROTEC	DIVERSITECH	BASX SOLUTIONS	NORTEK AIR SOLUTIONS	SILENT-AIRE	TRUaire	Service Logic
Acquirer	Schneider Electric	KKR	Carrier	Blackstone	ARISTON GROUP	PARTNERS GROUP	AAON	MADISON INDUSTRIES	Johnson Controls	CSW INDUSTRIALS	LGP LEONARD GREEN & PARTNERS
Date	Oct-24	May-23	Apr-23	Oct-22	Sep-22	Nov-21	Nov-21	Apr-21	Apr-21	Nov-20	Nov-20
Transaction Size	~$1,133M	~$305M	~$13,165M	~$14,000M	$1,000M	$2,200M	$180M	$3,625M	$870M	$360	>1,000

HVAC Focused Data Center Focused Key Liquid Cooling Transaction Comps

SOURCE: Pitchbook, Capital IQ, Factset, Company Filings

04 Public Company Comparables (1/2)

Valuation and performance benchmarks

Company	Total Debt ($M)	Cash and ST ($M)	Enterprise Value (EV) ($M)	Enterprise Value (EV)/ Revenue 2025E	Revenue 2026E	EBITDA 2025E	EBITDA 2026E	Price/Earning 2025E	Price/Earning 2026E
TRANE TECHNOLOGIES	4,615.0	774.2	99,160.7	4.6x	4.3x	23.0x	20.8x	33.8x	31.1x
Johnson Controls	11,645.0	731.0	86,107.3	3.6x	3.4x	21.5x	19.2x	37.6x	26.4x
VERTIV.	3,213.9	1,966.3	75,000.7	7.3x	6.1x	NM	26.5x	NM	38.9x
Carrier	11,887.0	1,797.0	60,004.1	2.7x	2.6x	13.0x	12.0x	33.7x	21.3x
nVent	1,898.6	125.8	18,496.8	5.0x	4.4x	22.1x	19.6x	NM	28.8x
SPX TECHNOLOGIES	1,019.3	134.3	10,563.5	4.7x	4.3x	21.2x	19.0x	NM	28.4x
AAON	335.8	NM	8,894.0	6.6x	5.8x	NM	27.5x	NM	NM
Munters	938.8	256.9	3,848.4	2.4x	2.3x	15.5x	13.2x	38.1x	24.1x
Mean				**4.6x**	**4.2x**	**19.4x**	**19.7x**	**35.8x**	**28.4x**
Median				**4.7x**	**4.3x**	**21.3x**	**19.4x**	**35.7x**	**28.4x**

SOURCE: Pitchbook, Capital IQ, Factset, Company Filings

04 Public Company Comparables (2/2)

Valuation and performance benchmarks

Company	Financial Data						Operating Performance			
	Revenue ($M)		Revenue Growth		EBITDA ($M)		2025 Operating Margins			
	2025E	2026E	'24E-25E	'25E-26E	2025E	2026E	Gross	EBITDA	EBIT	Net
TRANE TECHNOLOGIES	21,434.5	23,103.5	8.5%	7.8%	4,315.0	4,770.3	36.3%	20.1%	18.4%	13.6%
Johnson Controls	23,739.2	25,061.4	(10.9%)	5.6%	4,001.8	4,484.7	36.2%	16.9%	13.3%	10.3%
VERTIV.	10,227.1	12,199.7	30.6%	19.3%	2,208.7	2,833.6	36.4%	21.6%	20.2%	15.7%
Carrier	22,194.4	23,470.1	(2.5%)	5.7%	4,621.3	5,020.6	27.7%	20.8%	15.5%	10.5%
nVent	3,729.5	4,158.5	23.1%	11.5%	835.8	944.3	39.2%	22.4%	20.7%	14.5%
SPX TECHNOLOGIES	2,246.2	2,434.2	13.3%	8.4%	499.3	557.2	41.0%	22.2%	20.8%	14.0%
AAON	1,348.8	1,521.7	10.3%	12.8%	239.9	323.5	28.4%	17.8%	11.3%	8.3%
Munters	1,597.5	1,701.6	17.4%	6.5%	248.8	292.6	31.7%	15.6%	10.6%	6.2%
Mean		**11,706.3**	**11.2%**	**9.7%**	**2,121.3**	**2,403.3**	**34.6%**	**19.7%**	**16.3%**	**11.7%**
Median		**8,179.1**	**11.8%**	**8.1%**	**1,522.3**	**1,888.9**	**36.3%**	**20.5%**	**16.9%**	**12.1%**

SOURCE: Pitchbook, Capital IQ, Factset, Company Filings

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