Energy Supply Chain Overviews

Oct 16	RNG from Biodigesters
Nov 6	Geothermal
Nov 20	AI Data Centers: Structural Steel

Coming Soon – Natural Gas: Midstream, Solar, Circular Plastics, Hydrogen, and Electric Grid
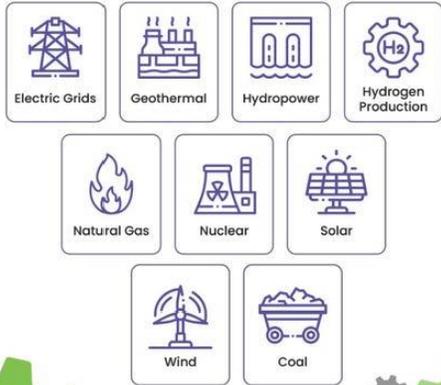
www.wemakeithere.org/energy/
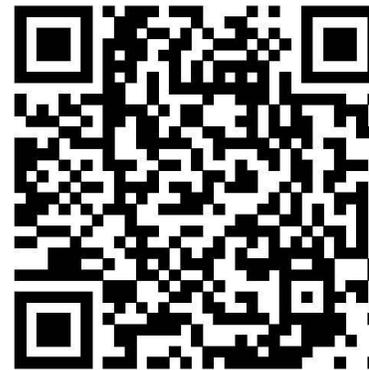
Industry Overview Segments
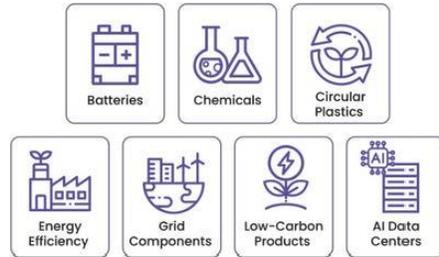
Nuclear Energy Industry Overview for Manufacturers

The nuclear industry is experiencing a resurgence, driven by the demand for clean, reliable energy, with small modular reactors (SMRs) emerging as a key innovation due to their smaller size, lower costs, and flexibility for applications like power generation and industrial heat. The global SMR market was valued at approximately $6.14 billion in 2023 and is projected to grow to $7.14 billion by 2030 at a compound annual growth (CAGR) rate of 3.0%, with some forecasts suggesting it could reach $16.13 billion by 2034 at a CAGR of 8.9%, fueled by decarbonization goals and technological advancements. Traditional nuclear power continues to provide about 10% of the world's electricity, while SMRs are expected to contribute 2% by 2043, supported by over 80 designs in development worldwide.

- **Download** the free Nuclear Report that identifies:
  - Market Size & Growth Forecasts
  - Market Drivers, Challenges & Concerns
  - Reactor Components and NAICS Codes of Suppliers
  - Contact – Developers, Manufacturers, & Trade Associations
  - Map of Today's Nuclear locations and links to key resources
- **Watch** the 30-minute video of Nuclear Report authors from the Penn State Extension Energy Team.
- **Print** a copy of the presentation notes
- **Click here** to view the press release.

Sample NAICS Codes

Manufacturing companies that work in these or similar NAICS (North American Industry Classification System) codes could be good

MANUFACTURING

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Provide support for small and medium-sized manufacturers interested in providing components for the potential market opportunity presented by AI data centers.

Forthcoming: Structural Steel, Racking, and Enclosures

AI Data Centers, Cooling, and Thermal Management: In the News
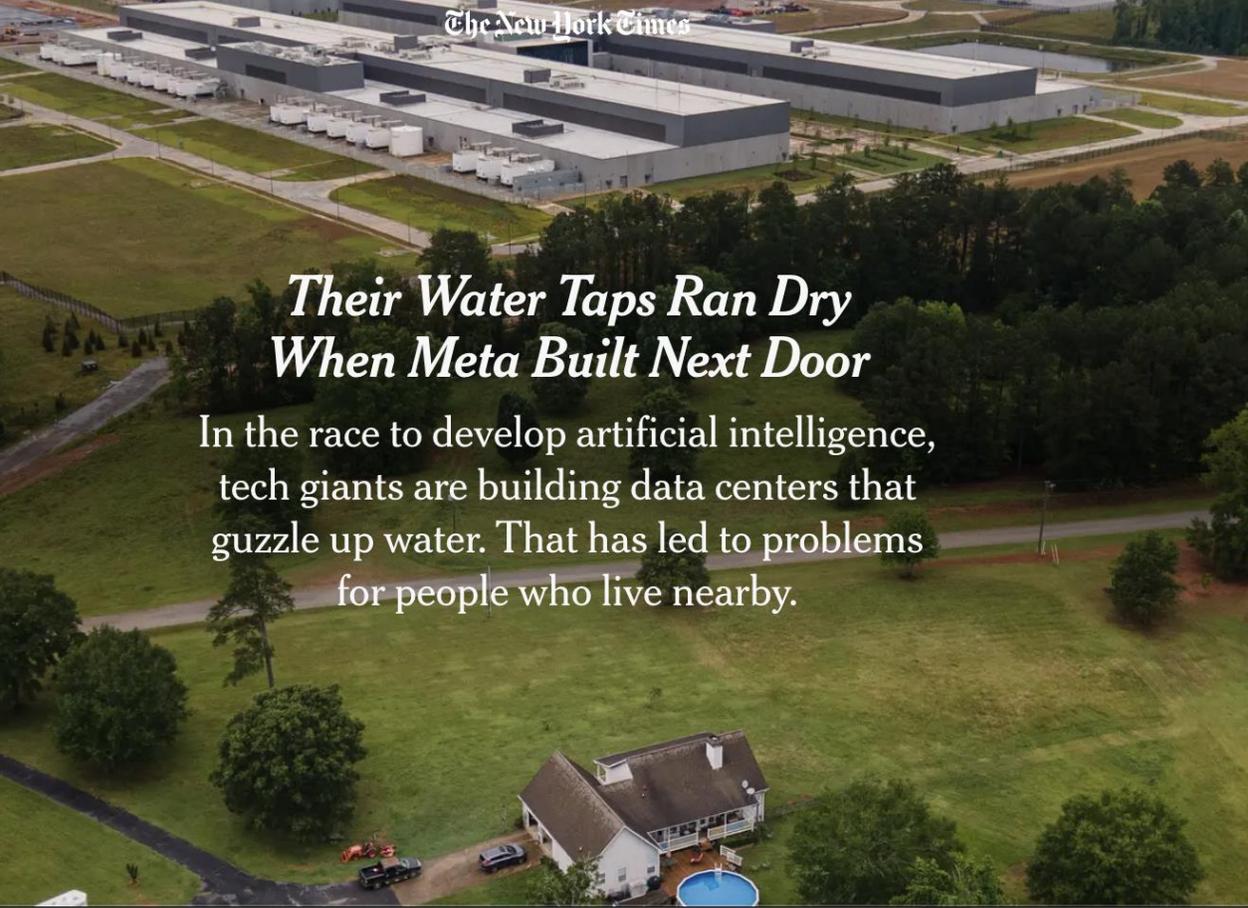
The New York Times

Their Water Taps Ran Dry When Meta Built Next Door

In the race to develop artificial intelligence, tech giants are building data centers that guzzle up water. That has led to problems for people who live nearby.

The Washington Post
Democracy Dies in Darkness

A new front in the water wars: Your internet use

In the American West, data centers are clashing with local communities that want to preserve water amid drought

Data centers are thirsty for Texas' water, but state planners don't know how much they will need

A wave of massive data centers is expanding across Texas, prompting warnings from experts who say the new water demands could push the state's already strained supply to the brink.

BY ALEJANDRA MARTINEZ   SEPT. 25, 2025   11 AM CENTRAL   SHARE   REPUBLISH ↗

After Meta broke ground on a $750 million data center on the edge of Newton County, Ga., the water taps in Beverly and Jeff Morris's home went dry.

The couple's house, which uses well water, is 1,000 feet from Meta's new data center. Months after construction began in 2018, the Morrises' dishwasher, ice maker, washing machine and toilet all stopped working, said Beverly Morris, now 71. Within a year, the water pressure had slowed to a trickle. Soon, nothing came out of the bathroom and kitchen taps.

Sources: New York Times, Washington Post Texas Tribune

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Study: Droughts, demand from AI, farming, pose risks for Great Lakes region water supplies

Matthew Rink
USA TODAY NETWORK

Oct. 1, 2025, 4:55 a.m. ET

As Pennsylvania begins playing a significant role in rapidly developing AI technology, a new report suggests that it and other Great Lakes states are ill-prepared for the increased demand that data centers will impose on their vast but limited water resources.

Cleveland MAGAZINE

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NEWS

As the Great Lakes Become a Data Center Hub, AI's Water Usage Impact Remains Unknown

AI data centers pose a threat to groundwater in the Lake Erie watershed, with only 1% of the water in the Great Lakes being replenished each year.

BY JADEN STAMBOLIA | JUN. 27, 2025 | 9:00 AM

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Source: Cleveland Magazine, GoErie

Data centers can use several million gallons of water a day, which is as much as a town with 10,000 to 50,000 people. In many places where data centers already exist, local communities have had issues with them over their water consumption.

As data centers multiply in the Chesapeake region, water use increases too

Whitney Pipkin   Jul 28, 2025 Updated   Jul 28, 2025   💬 0   📖 4 min to read

During a recent informational session at the College of Southern Maryland, Calvert County officials addressed the pressing issue of water usage in relation to the growing data center industry. The meeting highlighted the community's commitment to protecting local water resources, including public systems and aquifers, which are vital for both residents and the environment.

A key point of discussion was the significant water consumption required for cooling data centers. These facilities generate substantial heat due to the servers they house, necessitating effective cooling solutions. However, the conversation took a positive turn as officials noted that the data center industry is increasingly aware of water conservation needs and is exploring innovative alternatives to traditional cooling methods.

Among the solutions presented were the use of recycled water from treatment plants and air cooling systems. A notable example cited was the Frederick Project, which utilizes gray water from a local treatment facility to create a cooling loop for its servers. This approach not only conserves groundwater but also ensures that the water is returned to the treatment facility for further processing, thereby minimizing environmental impact.

Sources: Mountain State Spotlight, Bay Journal, Citizen Portal

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Environmentalists sound alarm as plan to convert Cayuga Power Plant to data center advances

TeraWulf intends to give a new life to the former Cayuga Power Plant at Milliken Station as a high-performance data center, but local critics warn the project could lead to the "next sacrifice zone."

by **Fernando Figueroa**, **Brian Crandall** and **Megan Zerez**   September 11, 2025

Even though some of the newer facilities at the Lake Mariner site tout their use of quieter static venting cooling systems, residents near the Somerset, N.Y. facility report constant noise pollution. Residents say the fans that cool some of the on-site computers produce a constant 95-decibel hum — about the same as standing next to a running lawnmower or motorcycle.

In 2014, when the power plant was still operational, it was permitted to draw a maximum of about 245 million gallons of cool water from the lake per day, according to permits from the New York State Department of Environmental Conservation. After cooling the plant's equipment, the system would release millions of gallons of heated water back into the lake.

The long-time practice had significant impacts on the surrounding environment: local anglers discovered fish were attracted to the warm water around the outflow and Milliken Point became a popular year-round fishing site.

The proposed data center will use the plant's existing water intake system to pull water from the lake to cool computers, but company representatives told town officials the facility does not plan to release warmed water back into the lake.

Instead, their plans currently call for the plant to use an evaporative cooling system, where water taken from the lake would dissipate into the atmosphere. According to the National Renewable Energy Laboratory, high-performance computing data center cooling systems still require a continuous source of water.

Source: Ithaca Voice

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Today's Agenda

How Does Advanced Cooling and Thermal Management Support Data Centers?

What to Know About Advanced Cooling and Thermal Management

AI Data Center Advanced Cooling and Thermal Management Related Components

Industry Resources

Questions & Answers

North America Data Center Cooling Market

Market Size Overview

14.75%

North America market CAGR, 2025 - 2033

USD 59.67 Billion

USD 19.85 Billion

Historical Data

Base Year

Forecast Year

2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033

Source: Market Data Forecast, 2025
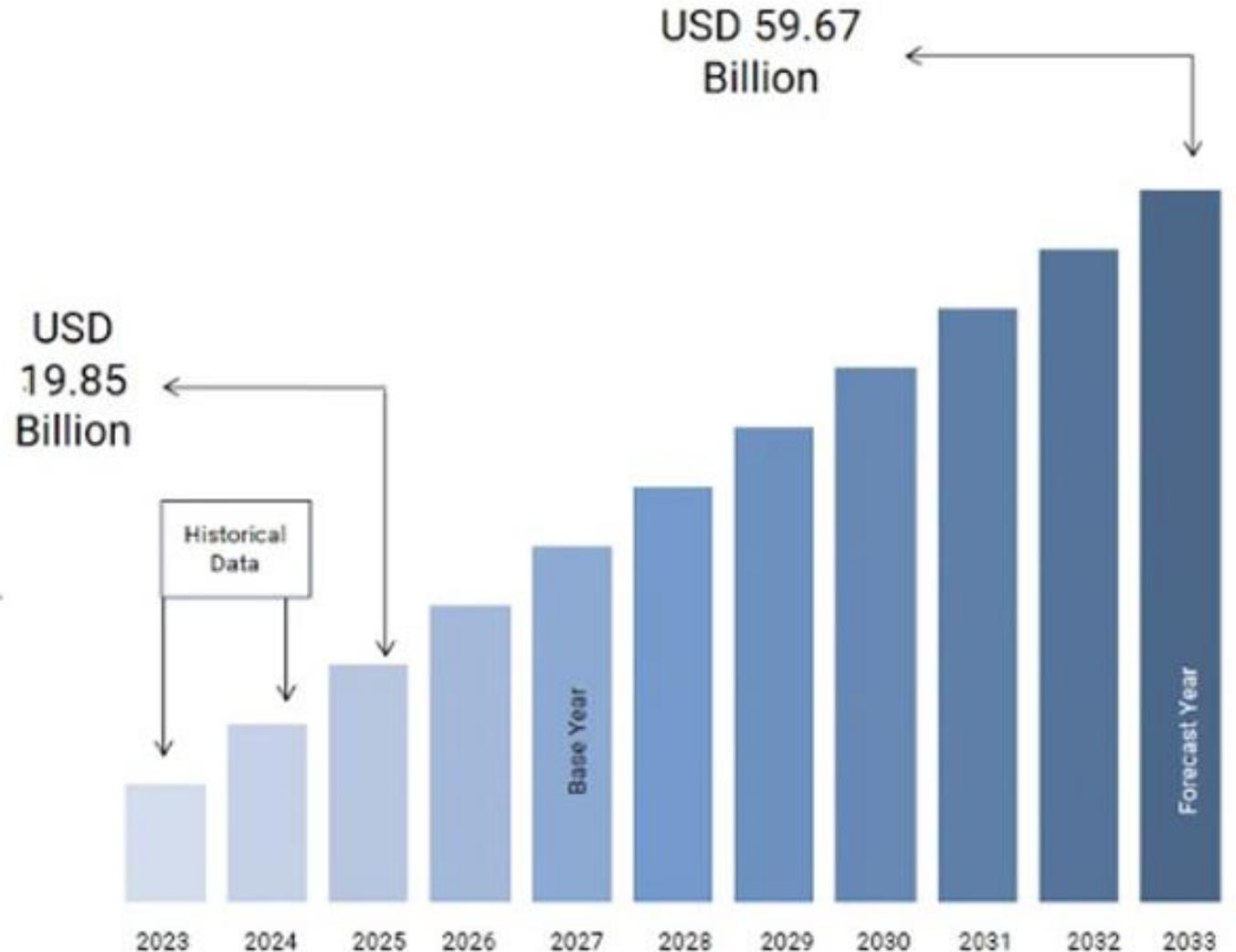
By Cooling Technology

- **Air Cooling:** Most traditional, includes computer room air conditioning (CRAC), computer room air handlers (CRAH), precision air conditioning, direct expansion (DX) cooling, evaporative cooling, and free cooling.
- **Liquid Cooling:** Includes direct-to-chip liquid cooling, immersion cooling, chilled water systems, and coolant distribution units. Growing fastest due to AI and high-density demands.
- **Hybrid Cooling:** Combines air and liquid cooling for optimized performance and efficiency.

By System Location

- **Room-Based Cooling:** Cools entire rooms using CRAC/CRAH units, prevalent in legacy and retrofit data centers.
- **Row-Based Cooling:** Cooling units placed between rows of server racks, targeting specific equipment rows for more efficient cooling.
- **Rack-Based Cooling:** Cooling directly integrated into or attached to individual server racks, including rear-door heat exchangers.
- **In-Rack/Direct-to-Chip Cooling:** Direct delivery of liquid coolant to hot components for precision thermal management.

By Application/Rack Density

- **Low Rack Density (<5 kW):** Traditional data centers, less intensive cooling needed.
- **Medium Rack Density (5–9 kW):** Most common, requiring enhanced airflow.
- **High Rack Density (>9 kW, up to 80+ kW):** AI and hyperscale data centers, demanding advanced cooling solutions (liquid, immersion).

TABLE: DATA CENTER COOLING SUBMARKET MARKET SIZE ESTIMATES, BILLIONS OF US DOLLARS

MARKET	2024 VALUE (USD)	2030-2034 PROJECTIONS (USD)	COMPOUND ANNUAL GROWTH RATE (CAGR)
Composite Market	$16.32–22.13B [1][8]	$40.72–56.15B (2030) [1][8]	16–21%, all segments

COOLING TECHNOLOGY

Air Cooling	$12–15B [1][2]	$17–22B (2030) [1][3]	6–8%, legacy/declining
Liquid Cooling	$5.38B [4][5]	$17.77B (2030) [4], $21.14B (2032) [5]	21.6–34%, rapid growth
Hybrid Cooling	~$4–6B [7]	$15–20B (2034) [7]	15–20%, gaining share
Room-Based	~$12B [2]	$32–36B (2033, North America only) [2]	10–12%, dominant share

SYSTEM LOCATION

Row-Based	$2–4B [2]	$5–10B (2033) [2]	6–8%, legacy/declining
Rack-Based	$1.5–3B [2]	$5–7B (2033) [2]	18+%, direct cooling

# What You Should Know About Cooling & Thermal Management

AI data center cooling and thermal management components are essential for overcoming the intense heat challenges presented by modern hardware. Together, they ensure safety, performance, and energy efficiency—cornerstones for future-proofing data centers in the AI era. Ideally, these components provide:

- **Equipment Protection:** They prevent overheating, which could cause hardware failure, fire, or data loss.
- **Performance Optimization:** AI servers operate at optimal performance only when kept within specific temperature ranges.
- **Energy and Cost Savings:** Efficient systems reduce cooling energy consumption, which can be 40% or more of a data center's total energy use.
- **Sustainability:** Advanced cooling reduces water and energy use, contributing to operational and environmental goals.
- **Scalability:** Modular and hybrid systems help data centers scale for future AI workloads without full overhauls.

Cooling systems drive much of energy consumption in AI data centers today

Computing power and cooling systems drive much of the energy consumption in AI data centers

Legend:
- Computing power and server resources
- Cooling systems
- Internal power conditioning systems
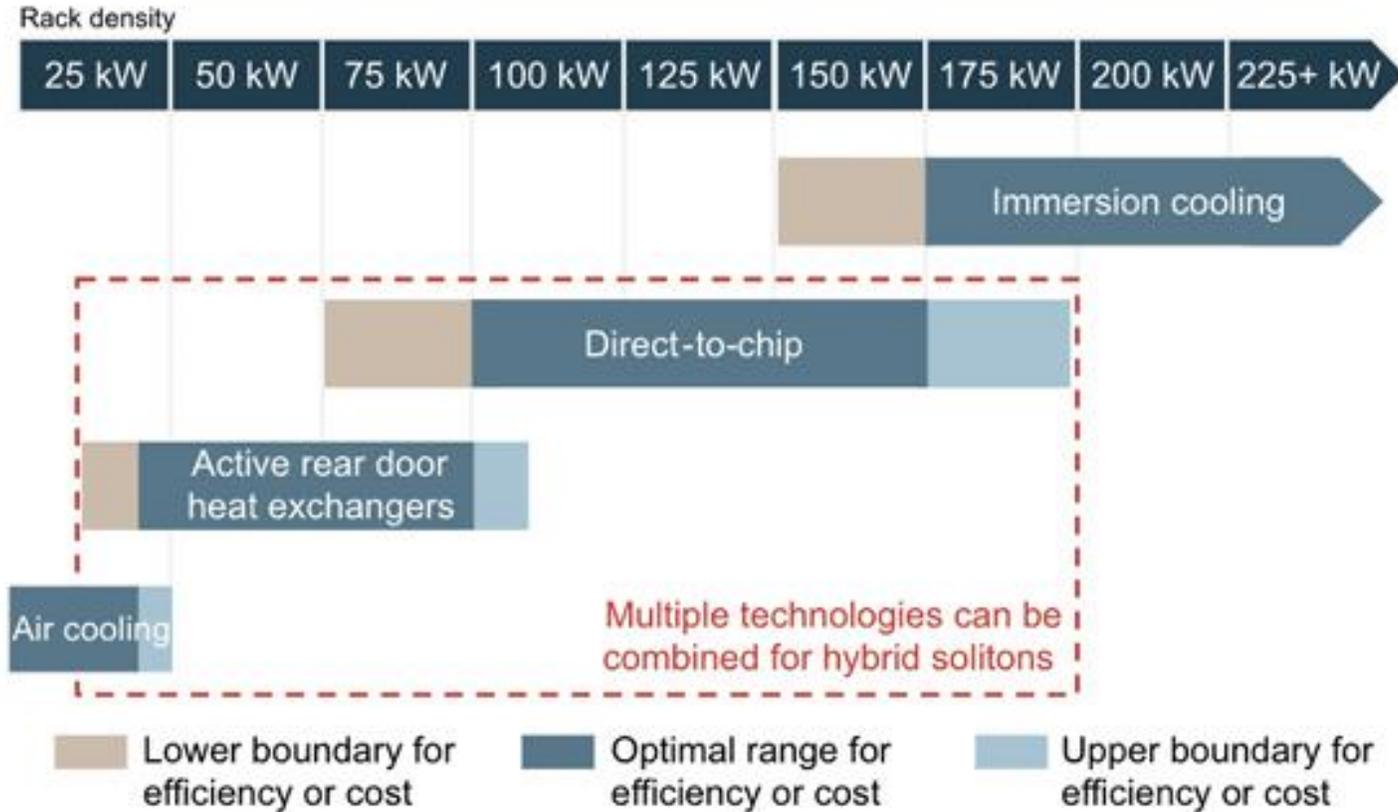- Network equipment
- Storage systems
- Lighting

Chart values: 40%, 39%, 10%, 5%, 5%, 1%
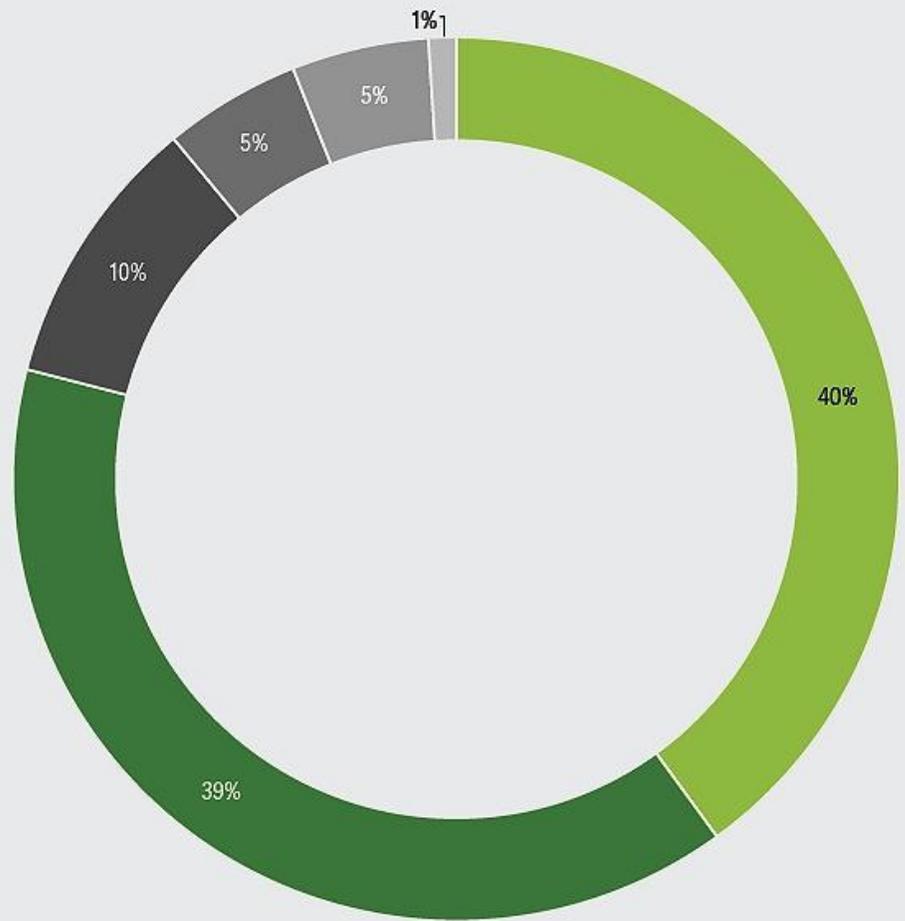
Source: Deloitte analysis.

Deloitte Insights | deloitte.com/insights

Source: Deloitte, 2024

Source: JLL, 2024

Environmental and Energy Impact of Cooling Systems Varies by Technology

Life-cycle Impact of New Cooling Technologies Compared to Air Cooling

Source: Microsoft
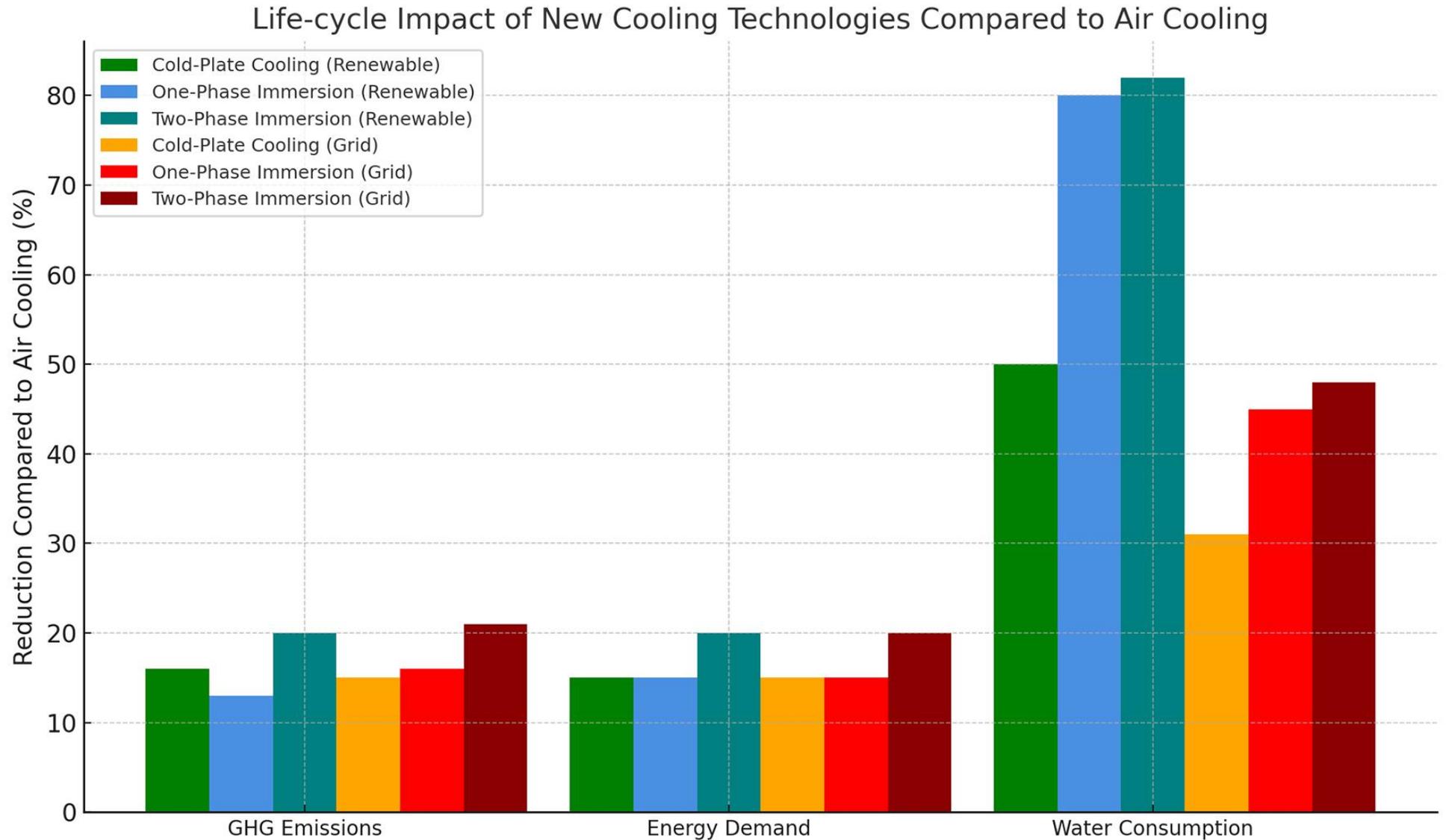
Emerging Technology: Liquid-to-Chip
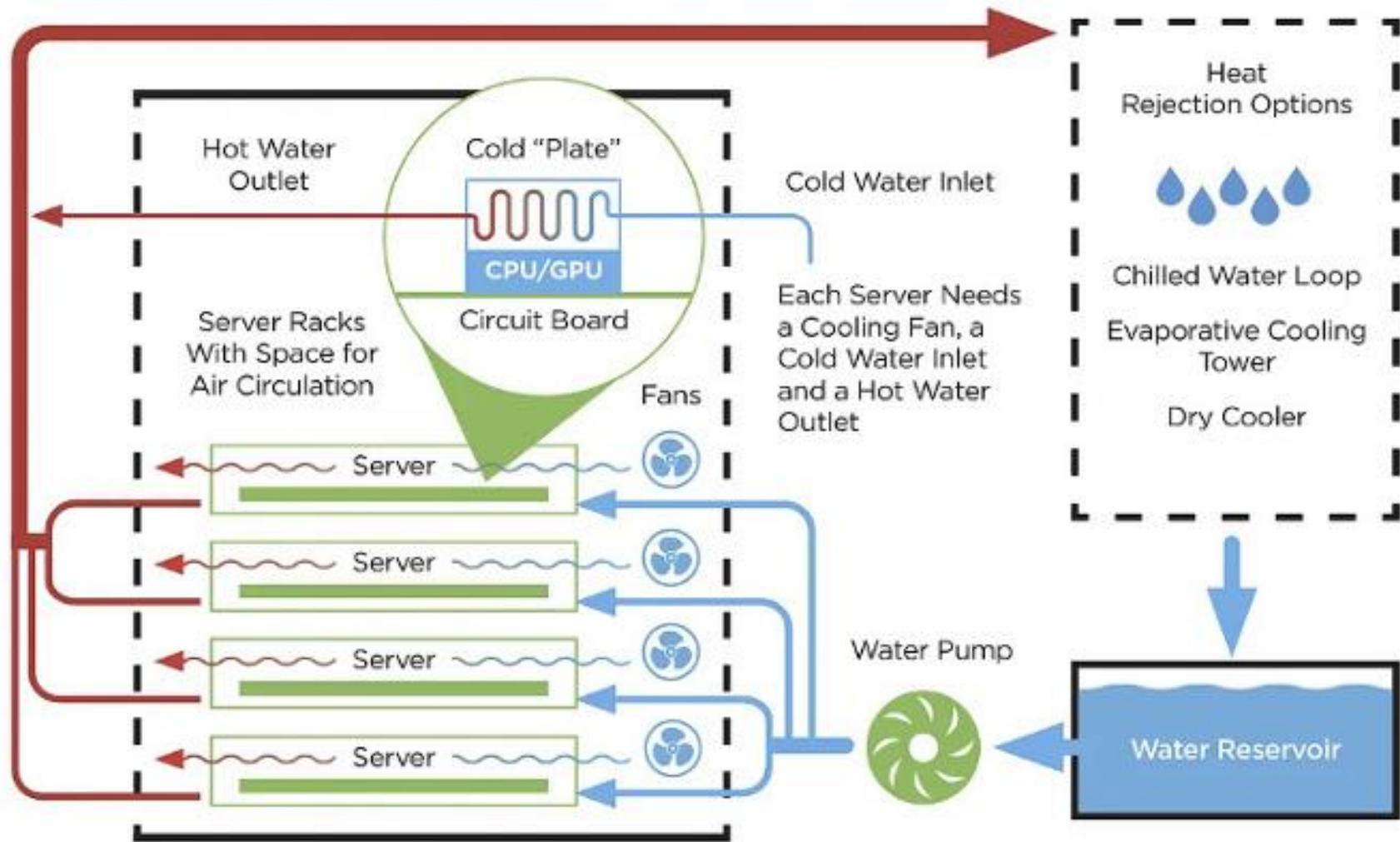
Source: Baycan, E., 2024

Emerging Technology: Liquid-Cooled Data Centers

Source: Semiconductor Engineering, 2024

Advanced Cooling and Thermal Management Components of Typical AI Data Centers

AIR HANDLING & CONTAINMENT

COMPONENT	NAICS NUMBERS	NAICS NAME	DESCRIPTION	USE
Air Economizers	333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing	Use outside air to cool the data center, reducing mechanical cooling needs.	Lower cooling costs and energy use.
Cold Aisle Containment	333415	Air-Conditioning and Warm Air Heating Equipment...	Physical barriers to contain cold air in server aisles.	Prevent cold/hot air mixing, improving efficiency.
Computer Room Air Conditioner (CRAC) Units	333415	Air-Conditioning and Warm Air Heating Equipment...	Precision air-conditioning units (air-cooled or refrigerant-based).	Provide precise temperature control for servers.
Computer Room Air Handler (CRAH) Units	333415	Air-Conditioning and Warm Air Heating Equipment...	Air-handling units using chilled water coils for heat removal.	Distribute cool air and manage airflow.
Direct Expansion (DX) Cooling Units	333415	Air-Conditioning and Warm Air Heating Equipment...	Systems using refrigerant that cycles directly through air handling units.	Small and edge data centers for spot cooling.
Dry Coolers (Fluid Coolers)	333415	Air-Conditioning and Warm Air Heating Equipment...	Air-cooled heat exchangers for removing heat from water/glycol loops.	Outdoor rejection of server heat into ambient air.
Hot Aisle Containment	333415	Air-Conditioning and Warm Air Heating Equipment...	Physical barriers to contain and direct hot air for return to cooling units.	Improve separation of hot/cold air streams.
In-Row Cooling Units	333415	Air-Conditioning and Warm Air Heating Equipment...	Cooling coils/blowers positioned between racks within the row.	Direct, localized cooling for high-density aisles.
Raised Floor Systems	238330	Flooring Contractors	Elevated flooring, space beneath used to distribute chilled air.	Enable flexible cooling and cabling layouts.
Rear Door Heat Exchangers	333415	Air-Conditioning and Warm Air Heating Equipment...	Warming/cooling coils on rear of racks to capture heat as it exits servers.	Precise rack-level heat removal.

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Industry Resources

## AI Data Center Trade Associations & Resources

TRADE ASSOCIATIONS

- **Air-Conditioning, Heating, and Refrigeration Institute:** AHRI represents manufacturers of HVAC and refrigeration equipment, setting performance standards and certifying system efficiency.

- **Air Movement and Control Association International:** AMCA develops standards and certifies equipment used for air movement and control in various HVAC and cooling applications.

- **American Society of Heating, Refrigerating and Air-Conditioning Engineers:** ASHRAE is the Industry leader in technical standards, research, and best practices for building and data center cooling, liquid cooling, and environmental management.

- **Associated General Contractors of America:** AGC represents a broad range of construction firms, including those specializing in data center construction.

- **Association for Computer Operations Management:** AFCOM focuses on education, networking, and best practices for data center managers and IT infrastructure professionals, particularly in the context of emerging technologies.

- **Data Center Coalition:** DCC serves as the membership association for the data center industry, advocating for favorable business climates, policies, and investments that support the sector's growth and success. DCC engages in public policy advocacy, thought leadership, and community outreach to promote the economic and community-building impacts of data centers.

- **Global Immersion Cooling Association:** GICA promotes standards, research, and best practices specifically for immersion cooling technologies in high-density data centers.

U.S. DEPARTMENT of ENERGY

Office of Manufacturing and Energy Supply Chains

The frontline of America's energy manufacturing and supply chain security

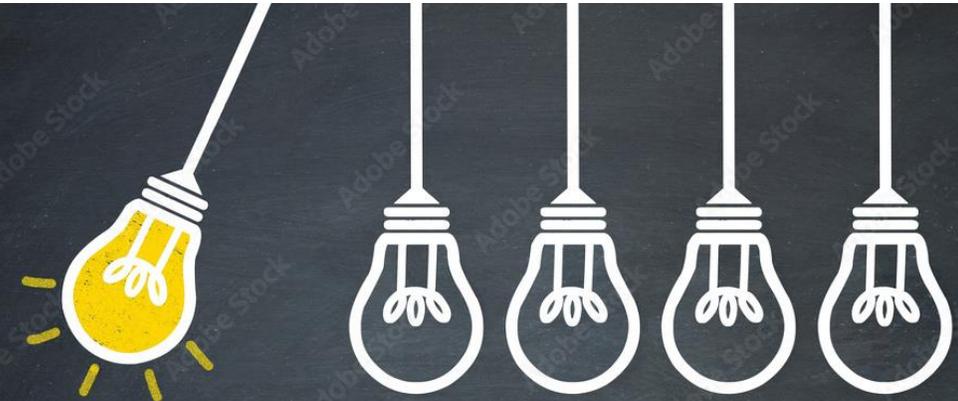**ENERGY & MANUFACTURING®**
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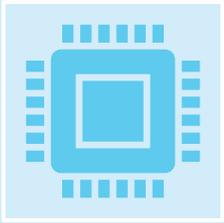
AI Data Centers are a potential major emerging market for small and medium-sized energy and electrical equipment manufacturers

AI company sustainability policies will likely drive new equipment purchases, though Trump Administration fossil fuel policies may counteract.

Sprint is needed to capture market opportunity at the regional, national, and global level

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AI Data Centers

AI Data Centers, specialized facilities designed to support the intensive computing and data storage needs of artificial intelligence applications, are rapidly becoming critical infrastructure as demand for high-performance computing continues to soar. As a result, they are a potential market opportunity for small and medium-sized manufacturers interested in providing components for AI data centers. The opportunity lies in agility: understanding specialized demand, aligning with environmental and regulatory shifts, and moving quickly to deliver next-generation components.

Overview

- Download the free **AI Data Centers:** Overview report that identifies:
  - Market Size & Growth Forecasts
  - Market Drivers, Challenges & Concerns
  - The Data Center Layout
  - AI Data Center Components and NAICS Codes of Suppliers
  - Contact – Developers, Manufacturers, & Trade Associations
  - Map of where Data Centers are emerging
- View the webinar recording of AI Data Centers.
- Click here to view the PowerPoint slides presented in the webinar.

Power & Electrical Infrastructure

- Download the **AI Data Centers: Power & Electrical Infrastructure** Report.
- View the webinar recording of AI Data Centers: Power & Electrical Infrastructure
- Click here to view the PowerPoint slides presented in the webinar.

https://www.wemakeithere.org/ai-data-centers-supply-chain/

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