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Understanding Data Centers and their Potential Impact on Power, Water and Wastewater Utilities

HEATHER CHESLEK, PE

GLOBAL INDUSTRIAL WATER SOLUTION LEADER

Agenda

Data Center Overview

Infrastructure

Power Demands

Water Cooling

Industrial Water Reuse

Information Gathering

Conclusions

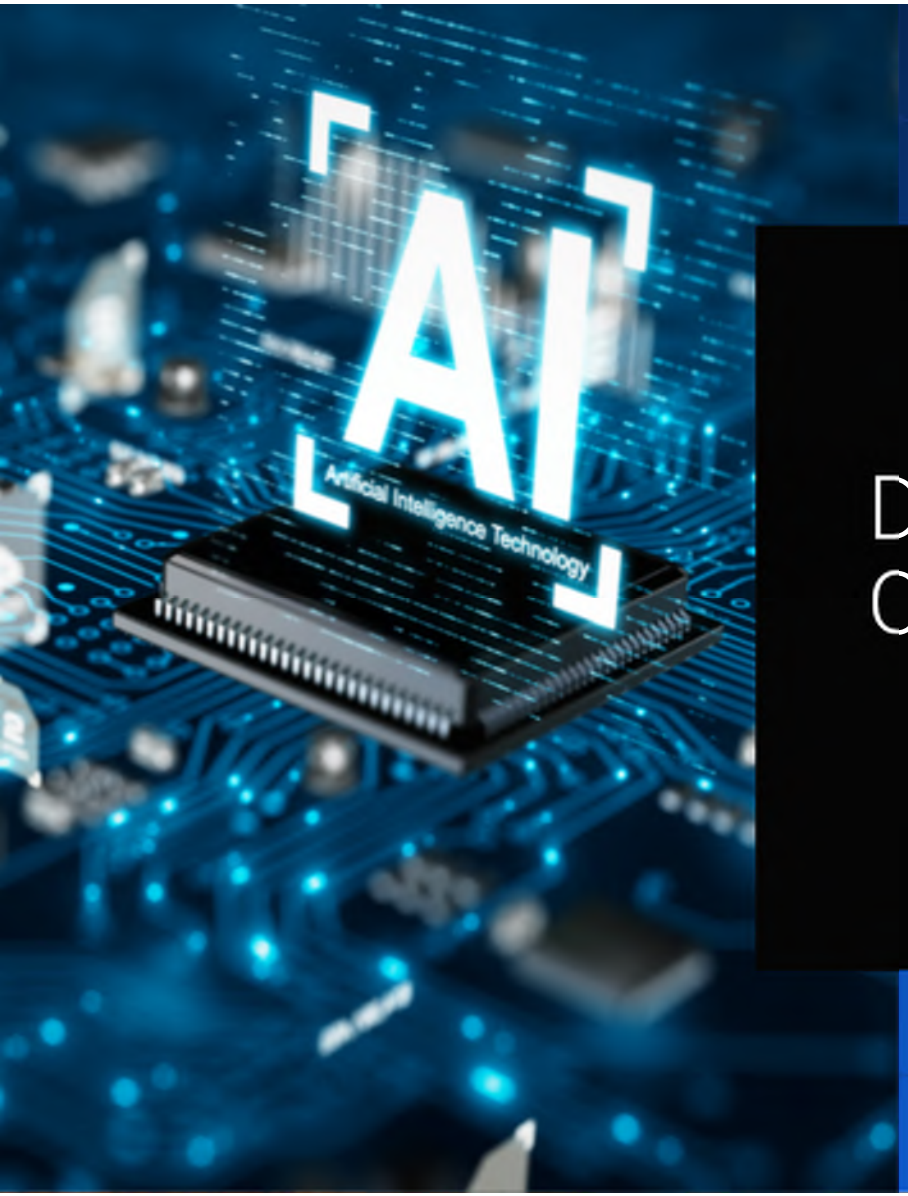
(What's not on the)

Agenda

Politics around data centers

Common Misconceptions of Data Centers

- Noise
- Potential of Increased Utility Rates
- Who Pays for What
- ….They are bad



Data Center Overview

Data Center Stakeholders

KEY STAKEHOLDERS

Hyperscalers

- Large-scale cloud service providers that require extensive computing resources to support their operations.
- The hyperscaler list includes companies like Amazon Web Services (AWS), Microsoft Azure, Google Cloud, Meta Platforms, Apple, and Oracle.
- They have set site due diligence format and design basis, and A/E focus on site adaptability using their set procedures.
- Investigate several sites at the same time

Developers

- Developer stakeholders provides secure and reliable colocation services, allowing businesses to house their IT infrastructure at their datacenters. Hyperscalers would typically lease colo space from the developers, as they are quicker to market in some locations.
- Need support with site due diligence, basis of design development, peer reviews, detailed design, etc.
- SDD and design is more of a phased approach.

Utilities

- Utility Providers and midstream gas providers.
- They have land available near their existing assets and looking to see if these would be feasible for Data Centers
- Need Power, Water and Fiber assessment with test fit development using general assumptions on design basis.
- Not typically looking to own and operate the data center but develop SDD enough to market to a Hyperscaler or Developer

Real Estate

- Real Estate companies looking to provide powered land deals to Developers and Hyperscalers.
- Need Power, Water and Fiber assessment with test fit development as well as interconnect application support.
- Not typically looking to own and operate the data center but develop SDD enough to market to a Hyperscaler or Developer

What is a Data Center?

A data center is a facility used to house computer systems and associated components, such as telecommunications and storage systems. It typically includes redundant or backup power supplies, redundant data communications connections, environmental controls (e.g., air conditioning, fire suppression), and various security devices.

Key Components:

- **Servers:** Powerful computers that store, process, and manage data.
- **Storage Systems:** Devices and technologies used to store data securely.
- **Networking Equipment:** Routers, switches, and other devices that manage data traffic.
- **Power Supply:** Uninterruptible power supplies (UPS) and backup generators to ensure continuous operation.
- **Cooling Systems:** Air conditioning and ventilation to maintain optimal operating temperatures.
- **Security:** Physical and digital security measures to protect data and infrastructure.

Data centers are critical for the operation of businesses, governments, and other organizations, providing the infrastructure needed to support digital operations, cloud computing, and data-driven decision-making.

Types and Reliability

Types of Data Centers

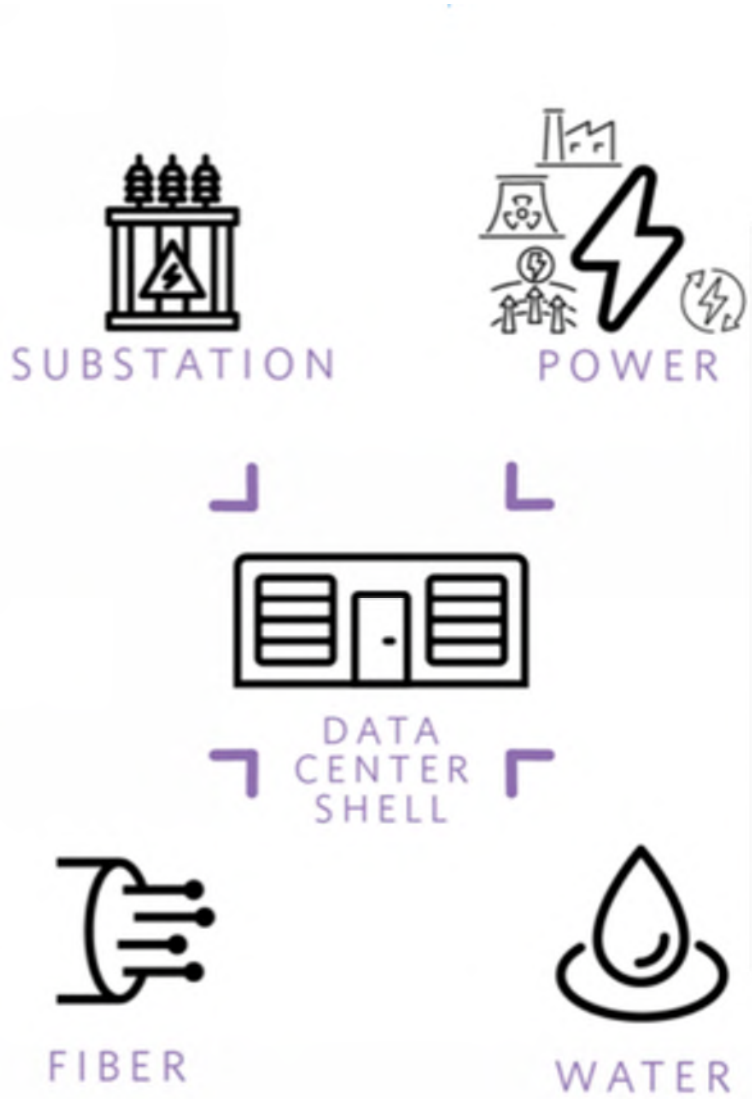
- Enterprise Data Centers (Hospitals, Universities, etc)
- Colocation (“Colo”) Data Centers (Shared space, Telecom Carriers)
- Hyperscale Data Centers (Meta, AWS, Google, etc)
- Modular Data Centers
- Edge Data Centers
- Neo-cloud Data Centers

Reliability

- Basic (99.671%) = 3.65 days of downtime annually

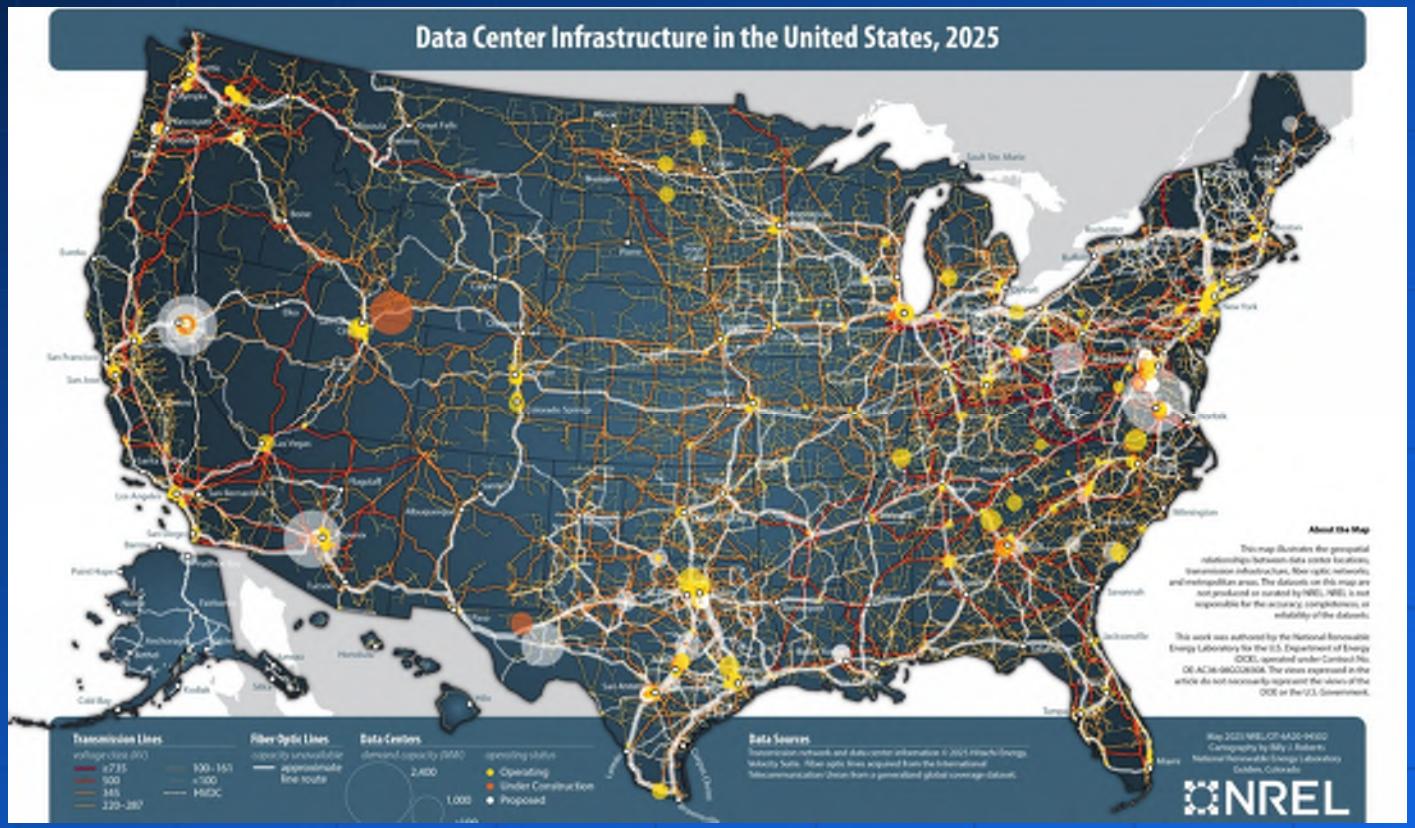
- Fault Tolerant (99.999%) = 5.26 minutes of downtime annually

Downtime = Lost Data, Functionality, Security, Revenue



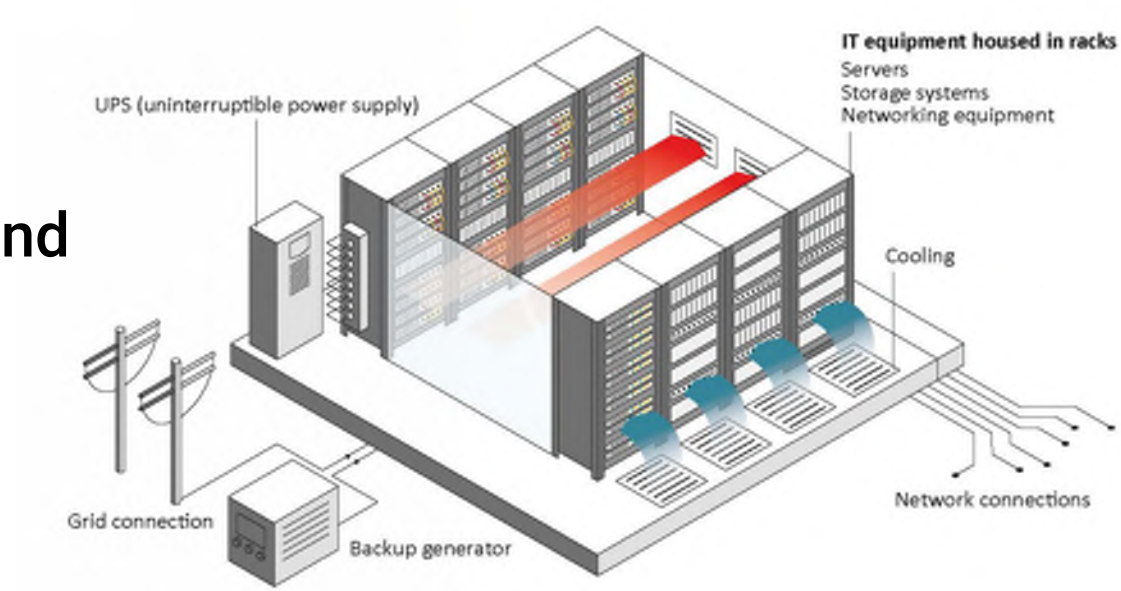
Infrastructure

Data Centers Massive Infrastructure Spanning the US



All Data Center Types Need Infrastructure

- **Power – 300 to 1 GW+**
- **Water Supply – 3 to 10 MGD**
- **Blowdown – 1 to 4 MGD**
- **Land – 500 to 1000+ Acres**
- **Fiber Connection – Single and Multi-Mode Fiber**



Source: IEA (2025)

How Long Does it Take to Build Data Centers?

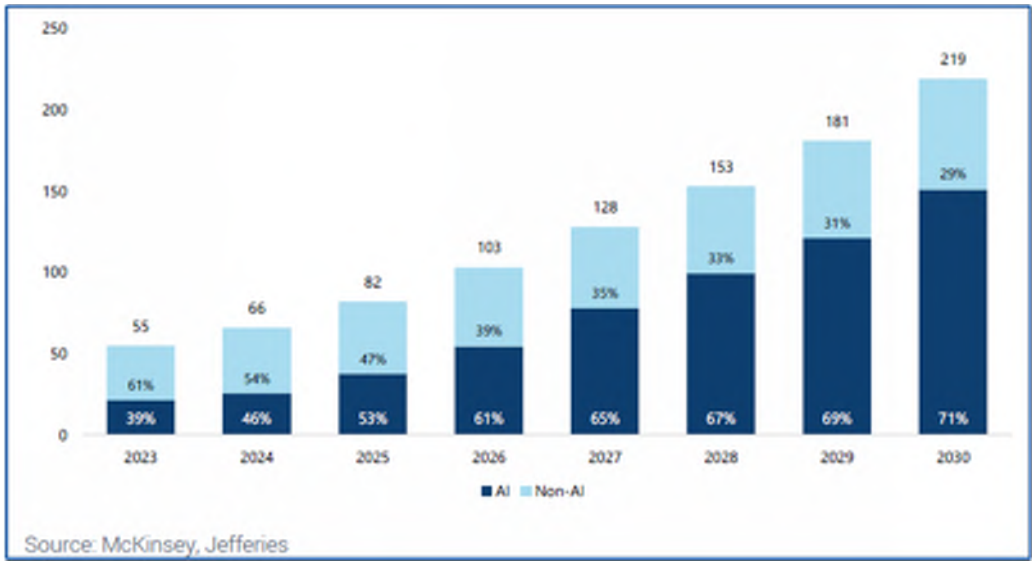
- **24 to 45 months from concept to commissioning**
- **Timeline factors include:**
  - **Project scale**
  - **Site conditions**
  - **Equipment lead times**
- **2 to 3 years to full cooling water use**

Hyperscaler (Columbus, OH)
Groundbreaking – June 2022 | Completion – December 2025 (42 months)

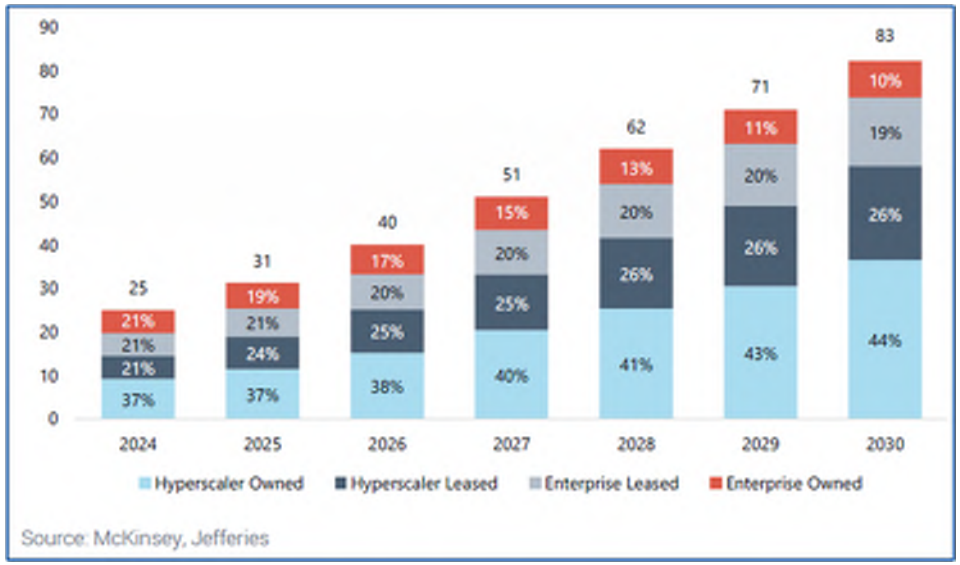
Power Demands

Power is Essential and Rapid Growth is Ahead

Global GW Demand by AI and Non-AI



U.S. Data Center GW Power Demand



How to Power Data Centers

- **Connect to the Grid**
  - **That used to be easy…**
- **Co-locate with a power plant**
  - **Data center new power plant – that used to be a red flag…**
- **Self generate**
  - **That's a bad idea – it just might work…**

Water Cooling

Data Center Cooling Water Supply Options

Cooling Water Supply

- Water Utility
- Reclaimed Water
- Surface Water
- Groundwater
- Seawater
- Brackish Groundwater

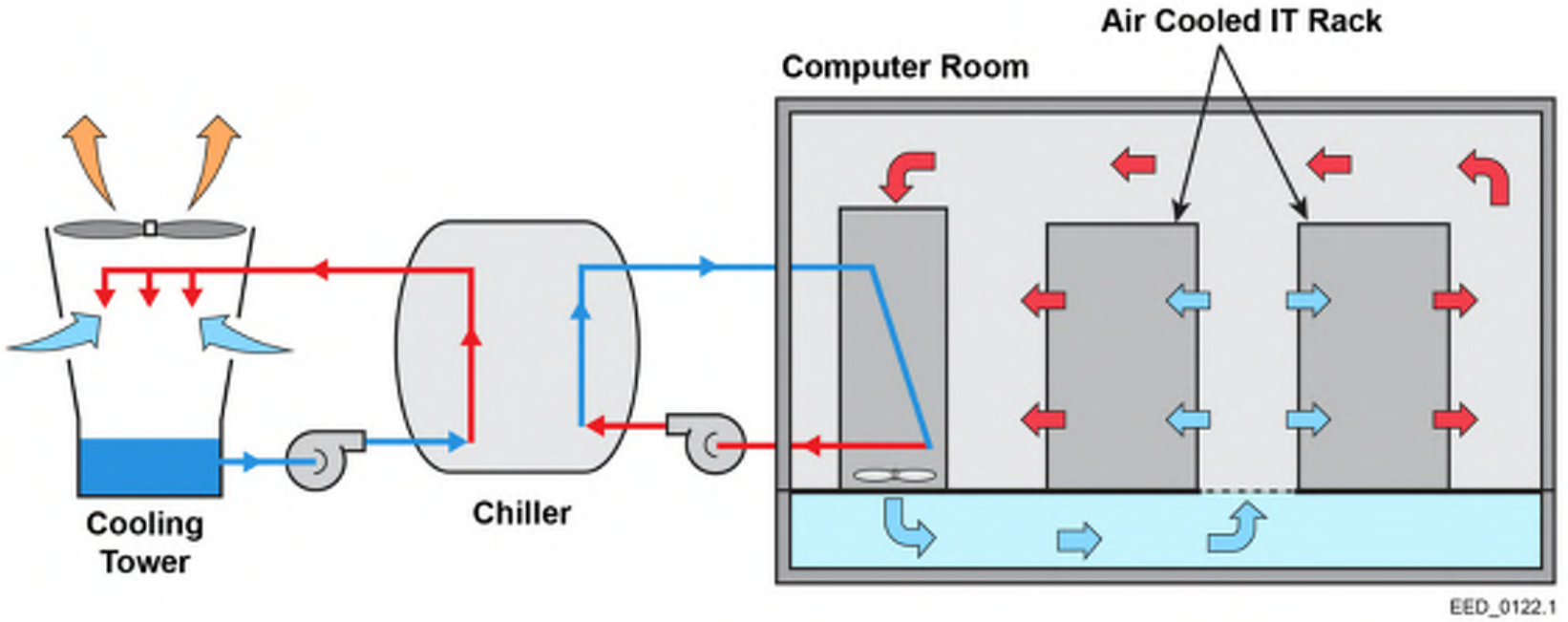
Cooling Water Supply Treatment

Blowdown Treatment

Blowdown Discharge

- POTW
- Surface Water
- Injection Wells
- MLD/ZLD
- Evaporation Pond

Data Center Cooling Towers



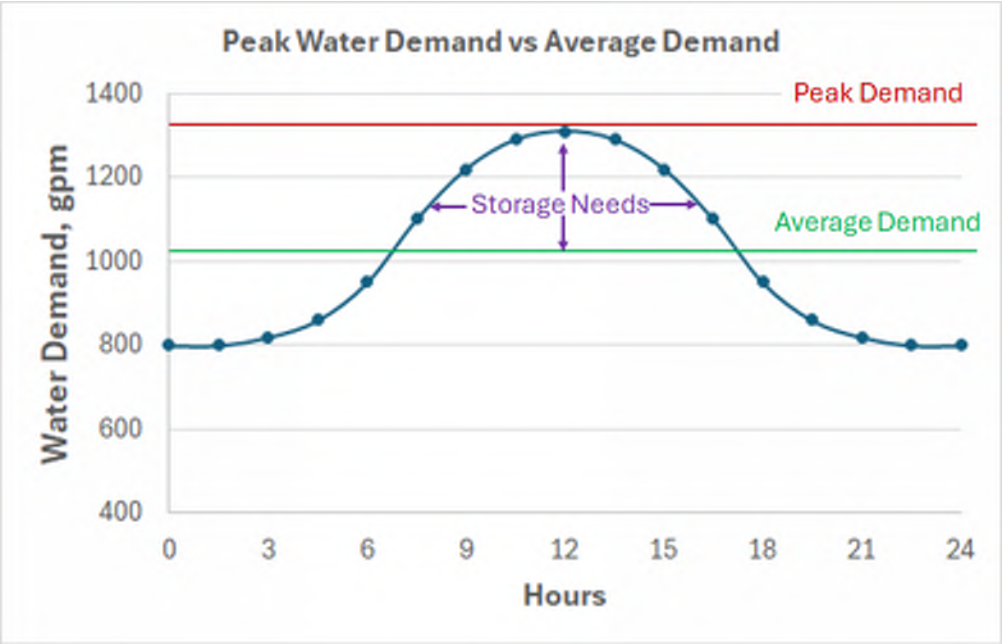
Cycles of Concentration (COC) – 3.5 to 6 Desired. Higher and lower COCs are possible, but have tradeoffs on volume and blowdown quality

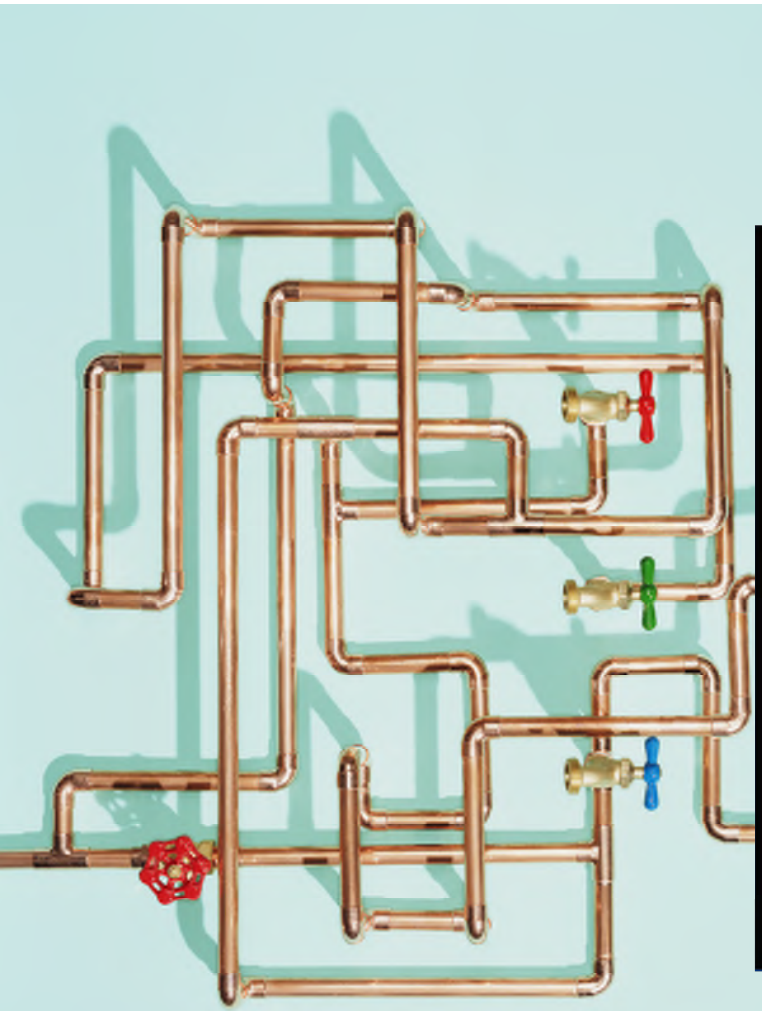
Cooling Technology Water Use

Cooling Technology	Chilled Water – Liquid Cooled Chillers	Chilled Water – Air Cooled Chillers	Direct Evaporative Cooling	Liquid to Chip, Supplemental Cooling
Key system components	Centrifugal chillers, open towers, plate frame heat exchangers, pumps	Air-cooled chillers with integral dry cooler economizers, pumps	Direct evaporative	Dry coolers with adiabatic peak shaving, pumps, cooling distribution units (CDU)
Maximum rack density	30 kw/rack fan wall 75 kw/rack rear door cooling	30 kw/rack fan wall 75 kw/rack rear door cooling	25 kW/rack	>150 kw/rack
Water use, annualized	**High.** Always uses water.	**Low.** Only needs initial water to fill the chiller water pipes and start up.	**Medium**	**Low.** Requires water for chiller pipes and start up. Peak shaving (if enabled) may only operate a few hours annually.
Winter cooling water use	Yes	No	No	No
Initial capital cost	$$$	$$	$	$$$$
Useful life (years)	20 to 25	15 to 20	15	15 to 20

Distribution System and Storage Requirements

- **Satisfy peak instantaneous water demand**
- **Sizing treatment and conveyance system to satisfy that demand is costly**
- **Provide on-site storage**
  - **Reduced treatment cost**
  - **Increased conveyance cost**
- **Provide off-site storage**
  - **Reduced treatment cost**
  - **Reduced conveyance cost**





Industrial Water Reuse

Water Quality for Reuse Water

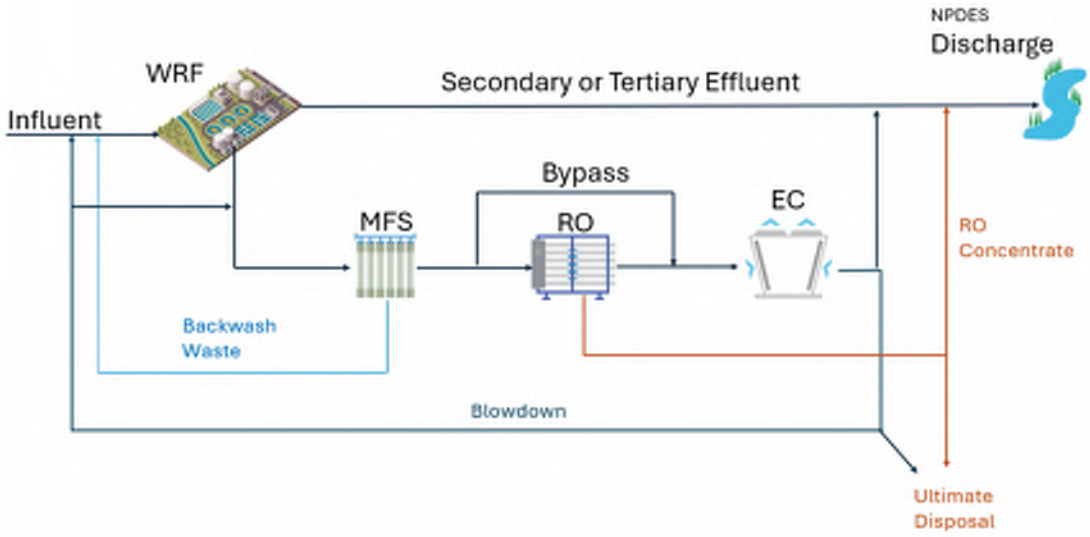
Parameter	Impact on Cooling Water Systems	Recommended Valve[1]
pH		7.0-9.0
Chloride ion, mg/L	Contributes to corrosion on most metals	<50
Sulfate ion, mg/L	Forms hard scale when combined with calcium	<100
Total hardness, mg/L as CaCO3	Contributes to scale	<200
Reactive silica (SiO2), mg/L	Forms hard to remove scale	<50
Total dissolved solids, mg/L	Contributes to scale	<500
Ammonia, mg/L	Contribute to biofilm growth, corrosive to copper fixtures	<2 (for copper corrosion)
Sulfides, mg/L	Contributes to corrosion	<10
Bacterial count, MPN/100 mL	Contributes to microbial growth and biofouling	<1,000
Turbidity, NTU	Contributes to biofilm formation and reduces efficacy of chlorine	<20

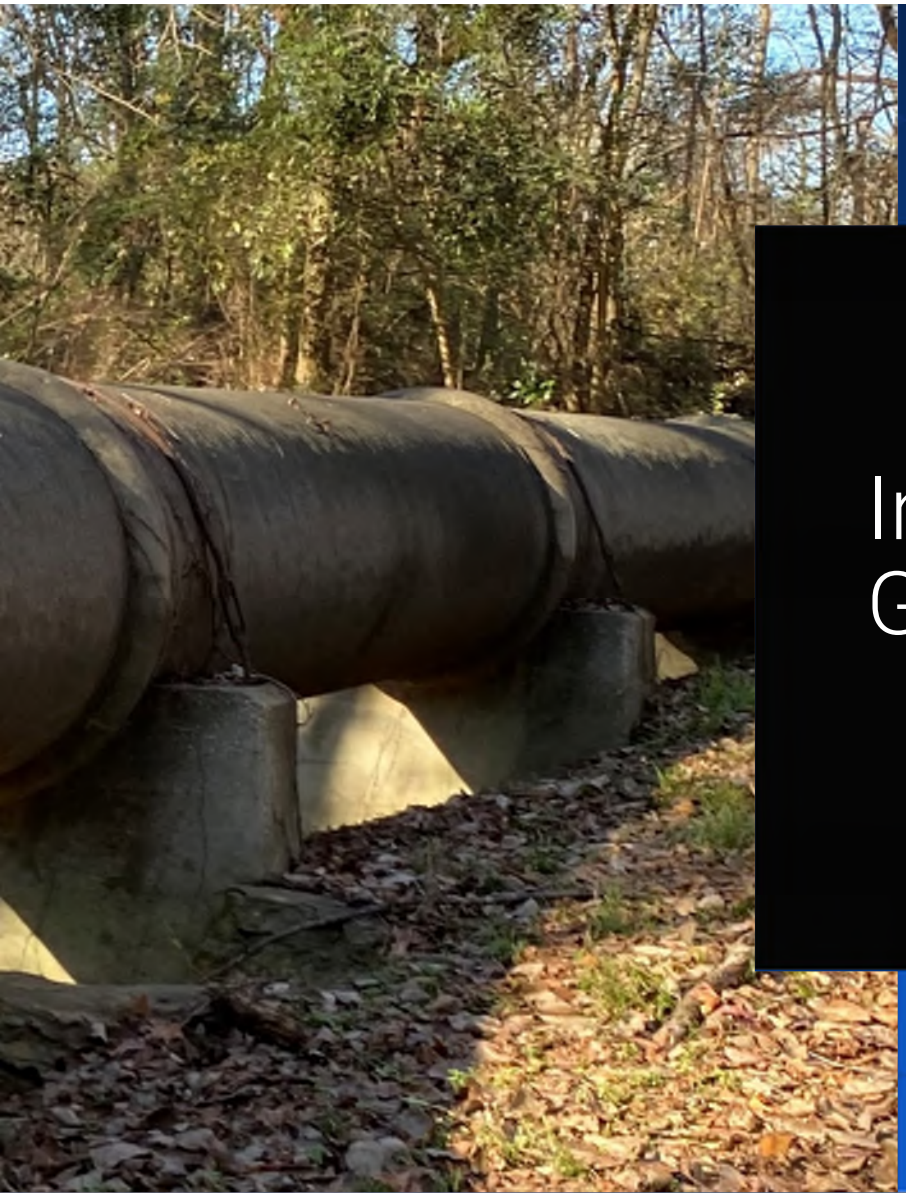
1 – American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE-D-90564) “Liquid Cooling Guidelines for Datacom Equipment Centers”

Increasing Industrial Use of Recycled Water

- **Proximity issue**
- **Competition**
- **Demand**
- **Storage**
- **Centralized Industrial Treatment**
- **Backwash waste handling**

Industrial Recycled Water Use Requires Planning





Information Gathering

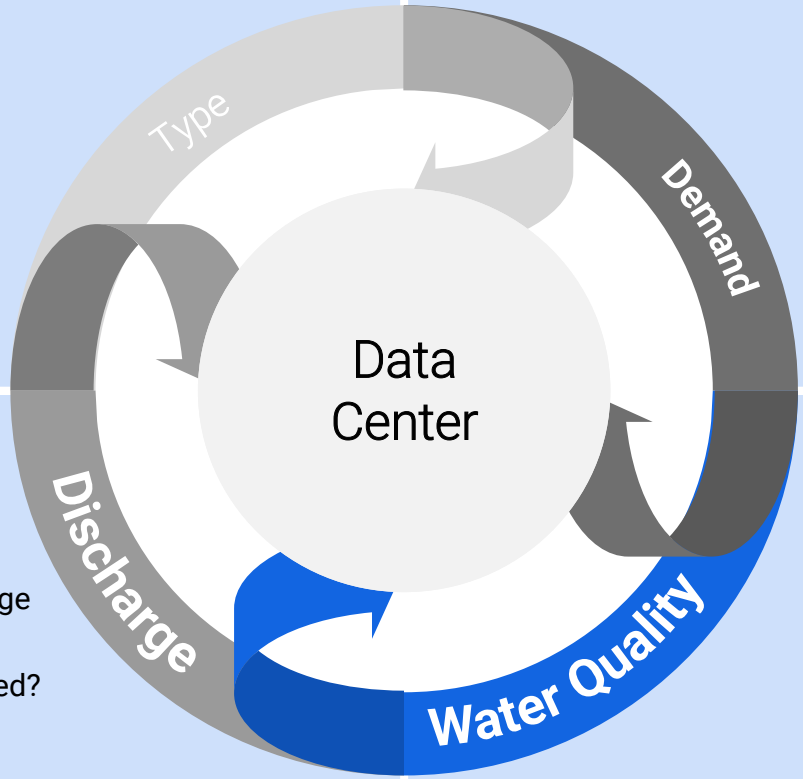
Information Gathering - Data Center

Data Center Info

- What type of data center - AI (Hyper) use more water?
- Is it an existing data center?
- Schedule for build-out and phase timing?

Power/Water Demands

- Ultimate build-out MW and phase timing
- What is peak water demand?
- When is peak water demand?
- How much water will be used in cooling?
- How will cooling system be operated?



Discharge (Blowdown)

- Where will cooling water be discharged?
- Where will they want to discharge at WWTP?
- What reserve capacity is required?
- Is treatment of blowdown required? (pH, temp, TDS)

Water Quality Requirements

- What is the water quality?
- What chemicals will be use in cooling towers?
- Will there be additional contaminants at start up conditions?

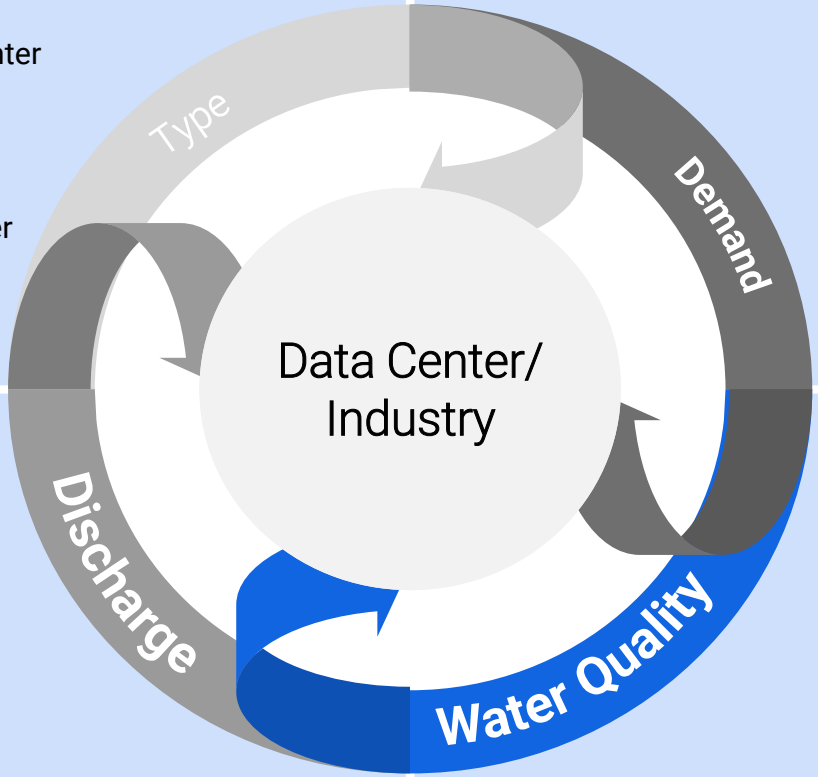
Information Gathering - Utility

Data Center Growth

- When will expansion of data center occur?
- Will the growth be scheduled or phased?
- What will be the ultimate number of data centers?

Power/Water Demands

- Grid capacity, availability and interconnection process?
- How can capacity be supplied? Infrastructure improvements needed?
- Can water reuse be considered?
- What is required for reliable water supply?



Discharge (Blowdown)

- Will a reservation be allowed?
- Will acceptance impact growth?
- Will there be impacts to NPDES permit?
- Will the “clean” blowdown effect the WW treatment processes?

Compliance Strategy

- Does local discharge code need to be updated?
- Does a source control plan need to be developed?
- Does a permitting/ enforcement strategy need to be developed?
- Does IPP include data centers?

Conclusions

- **Data Centers are here to stay and growing**
- **Power is driving data center locations but water capacity is a close second**
- **Industrial water use demand for cooling is increasing**
- **Recycled water is an available water source and can be fit-for-purpose treatment**
- **Influent water quality to key to data center operation and effluent quality**
- **Water utilities can adapt traditional water supply models to meet the specific needs of the industrial cooling industry**
- **Wastewater utilities should be mindful of effluent quantity and quality and its effect on treatment processes.**
- **Data gathering is crucial to outline fatal flaws**

Thank You!

Heather Cheslek – cheslekha@bv.com