NYWEA/NEWEA Joint Meeting

Quenching the Datacenter Thirst

Managing Cooling Water Demands

Brandon Yallaly, P.E.

Darcy Sachs

June 8, 2023

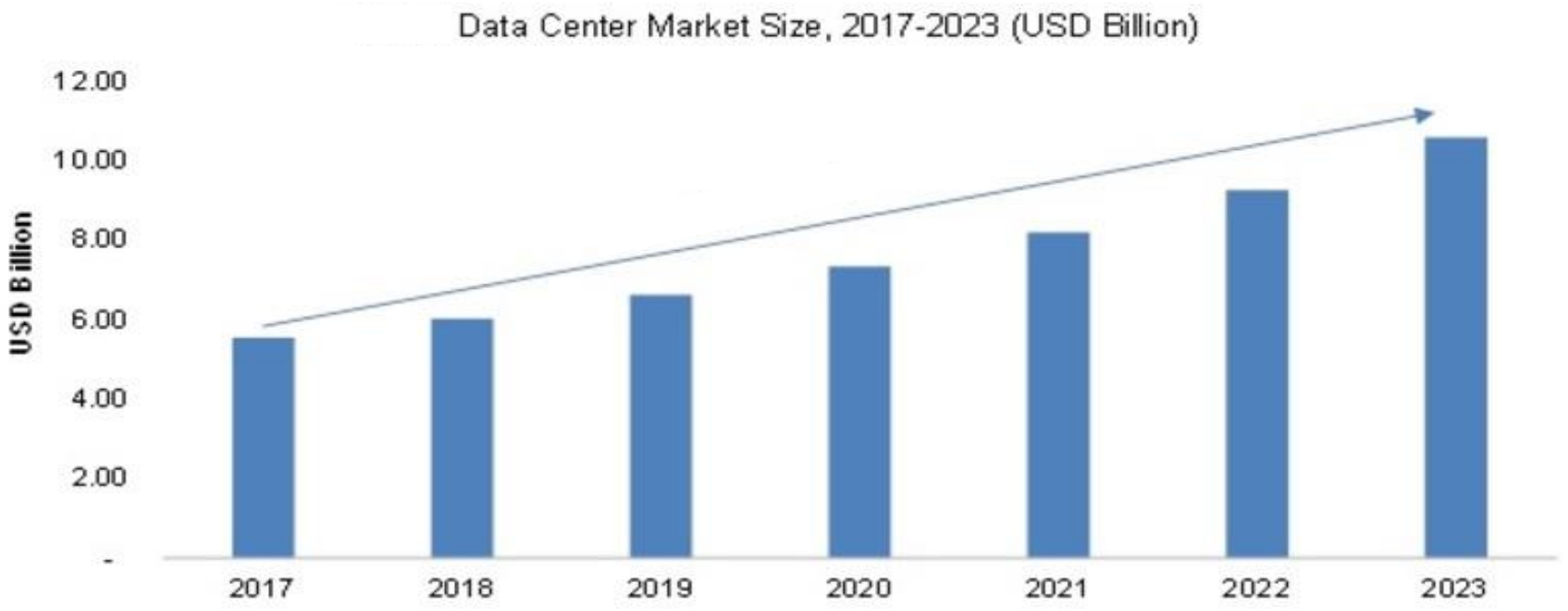
// Agenda

- Datacenter Growth
- Sustainability
- Technical Challenges
- Potential Solutions (Case Studies)


Datacenter Growth

// Datacenters: Fast Growing Industry

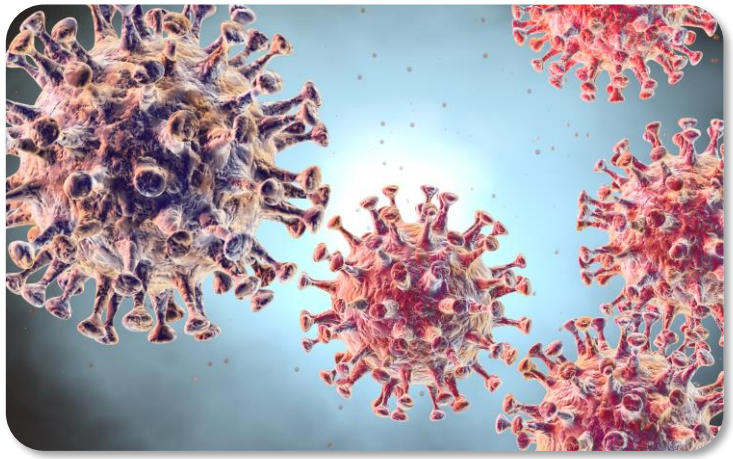
- In US the Datacenter Market is currently $8.4 Billion
  - Expected $14 Billion by 2026…..**8.6%** CAGR
- Globally, $187.35 Billion
  - Expected $517 Billion by the year 2030…..**11%** CAGR



// Growth Drivers

The Newest Utility Providers

Mobile Devices and Autonomous Driving

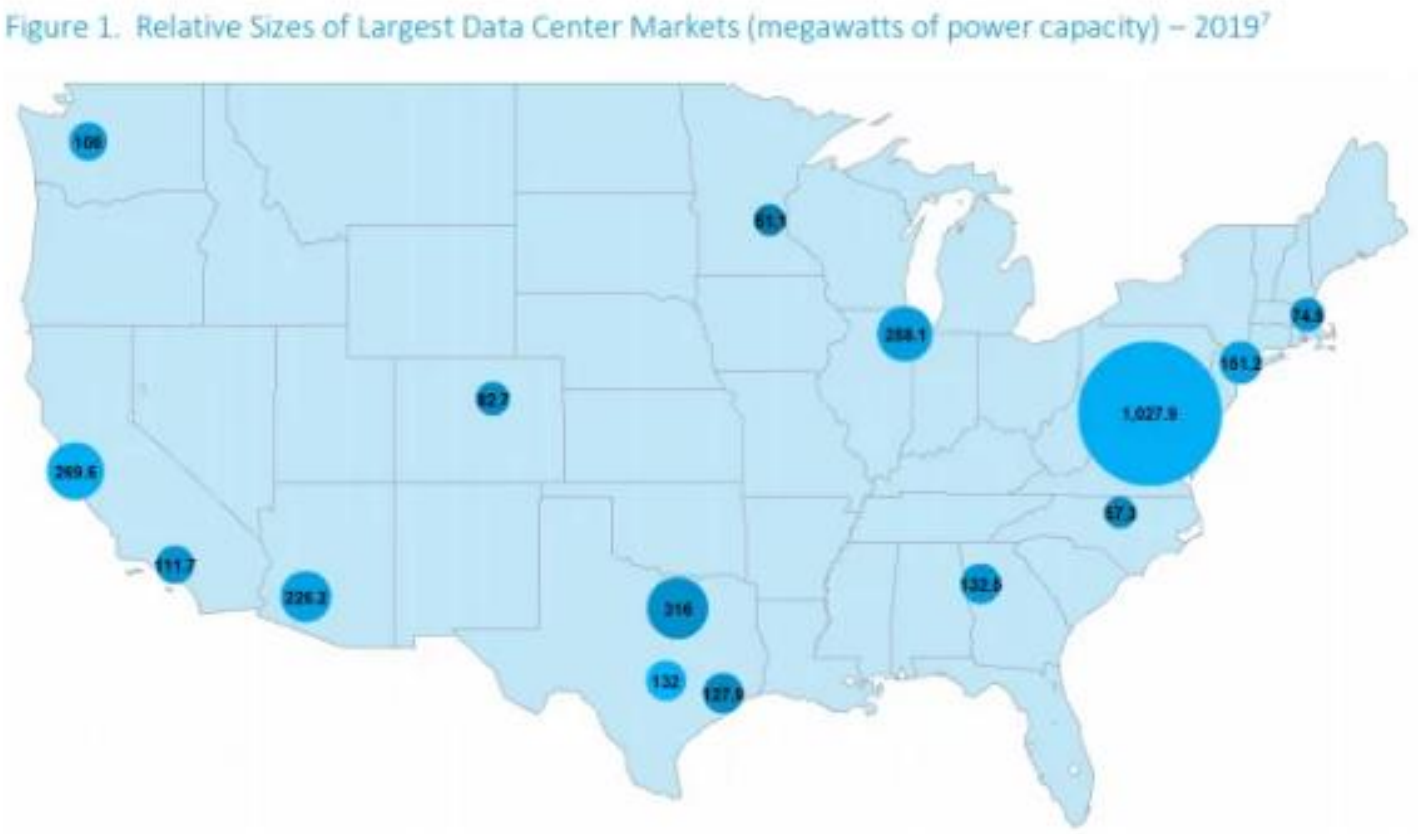


Remote Working, Streaming Service Growth

// NY and NE are growing spots for Datacenters

- NY – Currently 106, 51 NYC
- CT – 17
- MA – 41, ~ 3/4 in Boston
- ME – 3
- NH – 7, half in Manchester
- RI – 5, Providence
- VT – 3

- Some state government support



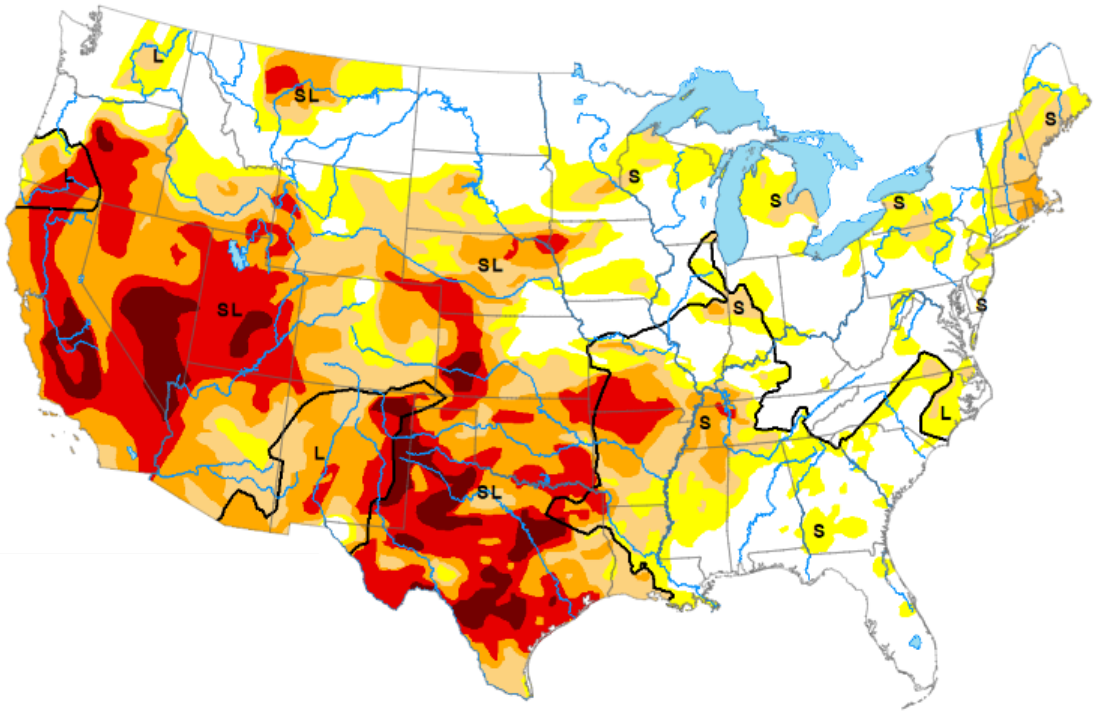
(NVTC).

// Datacenters have Significant Cooling Needs

- Datacenter operators need to control the temperature inside the data center to reduce heat.
- Reduce risk of servers overheating, server failure.
- Optimize energy usage by the servers.
- Results in significant wastewater discharge

// Typically Use Water Based Cooling

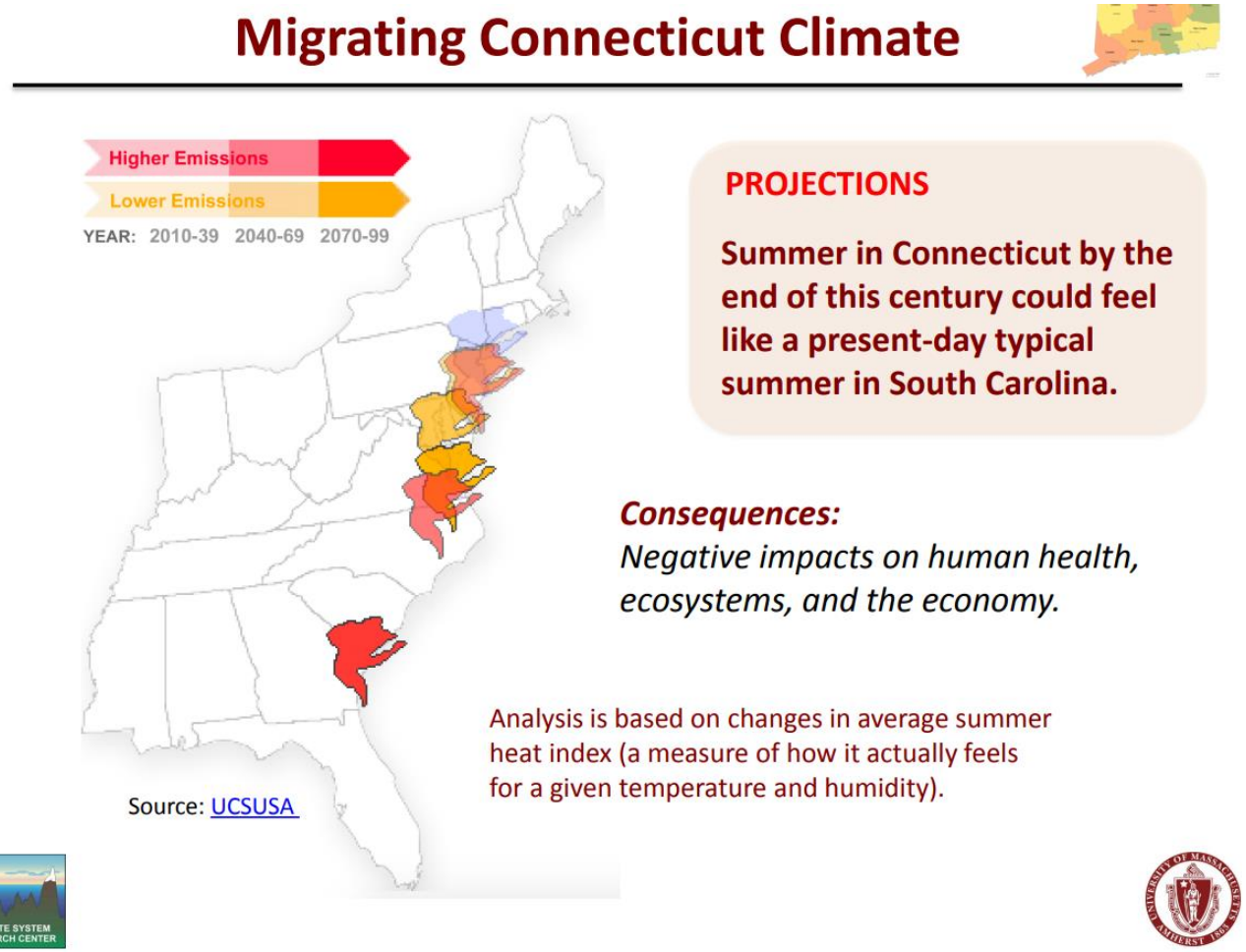
- More cost effective and energy efficient
- Datacenter operators don’t want to be in the business of running or maintaining water treatment facilities. They would rather:
  - Outsource to local municipality,
  - Pay a premium for infrastructure upgrades, or
  - Include in water/wastewater rates.
- Climate Change
  - Huge concern
  - Water availability is becoming the most important factor for siting Datacenters



Sustainability

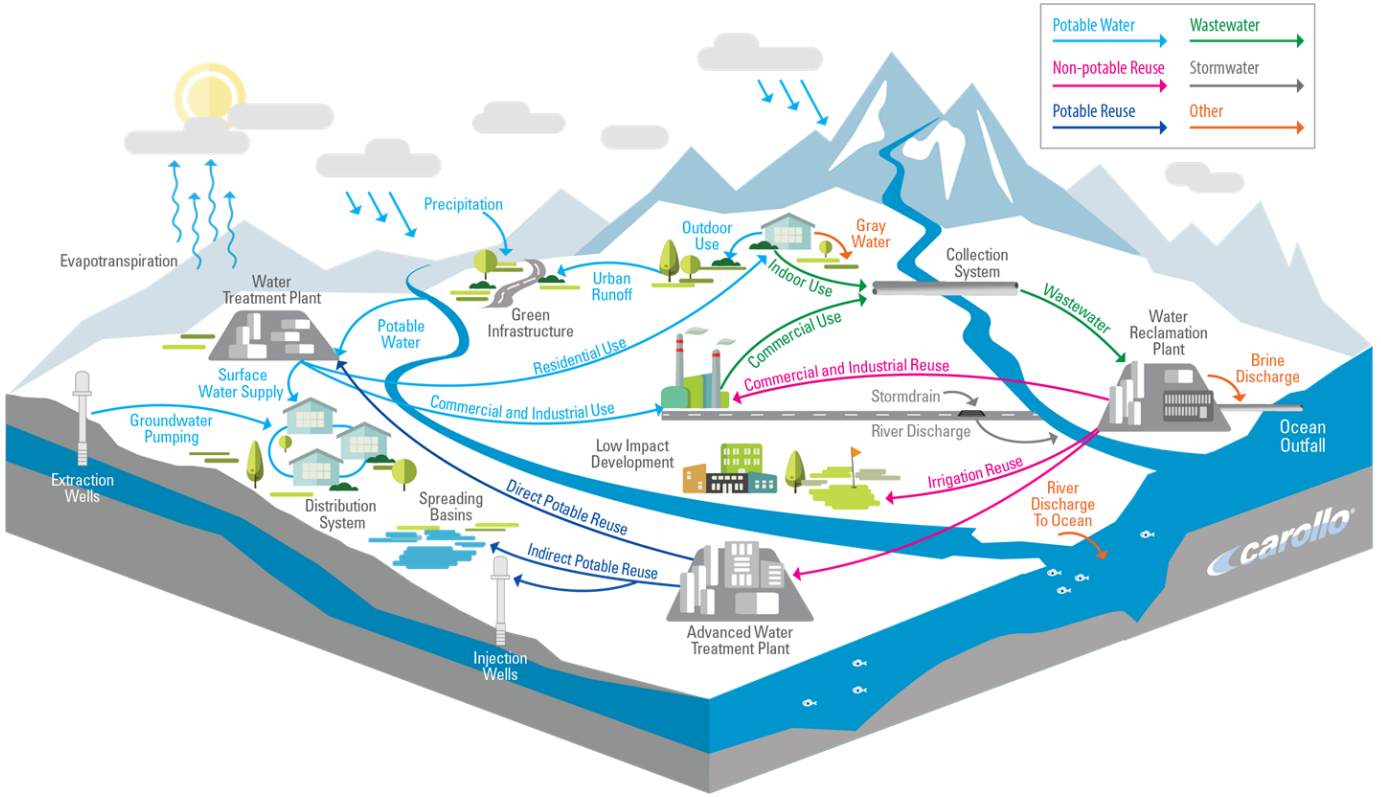
// Northeast Climate Change

- New England/NY
  - CT example
  - Emission scenario dependent
  - Equivalent to Delaware/Northern Virginia in 10 to 20 yrs.



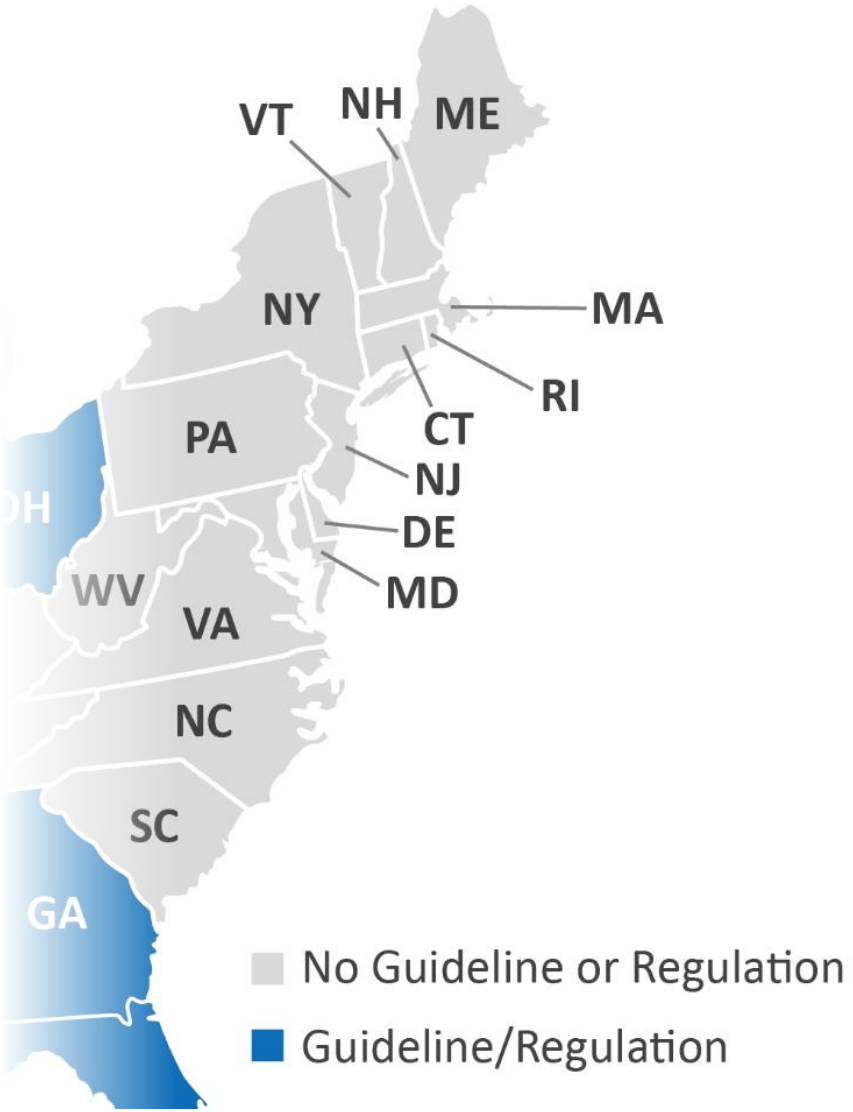
// All fresh water is reuse water

- Defacto reuse
  - Indirect
  - Discharge to ground water/surface water
    - Water withdrawal regulations
    - Water quality standards/guidance are protection
    - Overlays of other regulations
- PFAS, total dissolved solids (TDS)



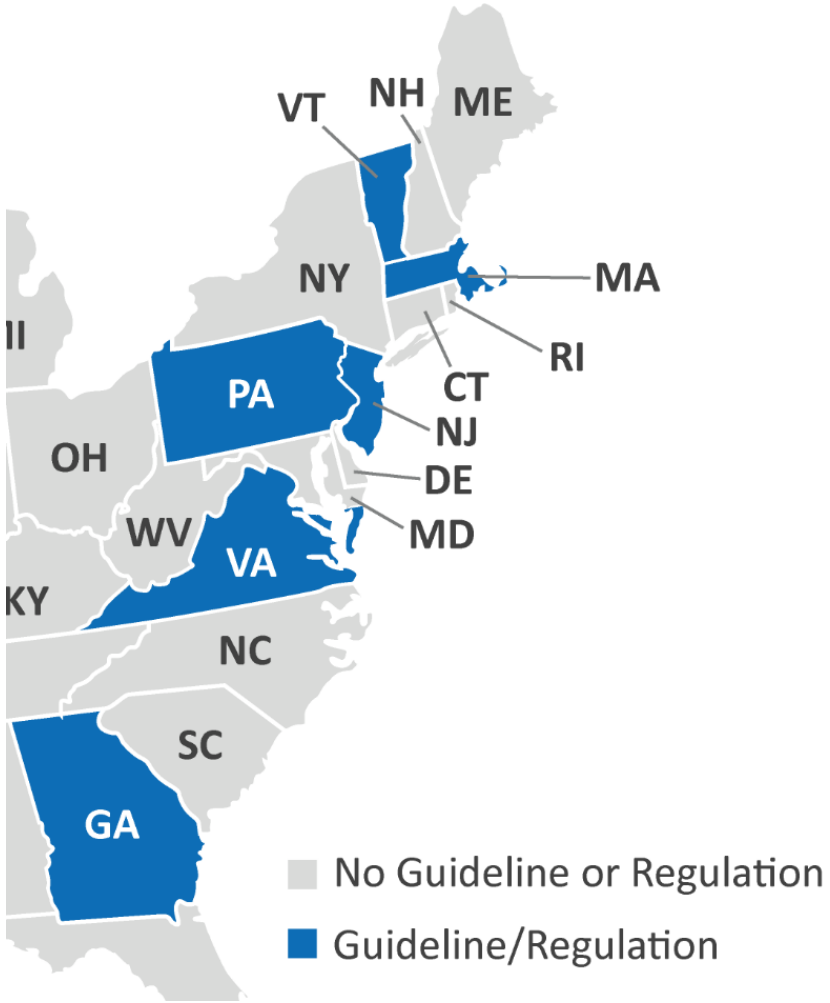
// Onsite Non-Potable Water Reuse

- Industrial Reuse
  - RI, MA
  - BOD_5, TSS, Turbidity, pH, TN, Fecal coliform or E. coli
  - Human health risk drives other treatment – Log_{10} reductions
    - Parasitic protozoa, Viral load
    - High-rate filtration (disc filter), UF, UV disinfection, chloramination
- Northeast Confidential Manufacturer
  - Mist from paper machine
    - Human exposure
  - Treatment selection to eliminate bacteria/virus
    - Source municipal treatment system effluent



Source: https://www.epa.gov/waterreuse/maps-states-water-reuse-regulations-or-guidelines

// Centralized Non-Potable Reuse Regs/Guidelines



- VT, MA
  - WWTF with a surface water discharge.
  - WWTF discharge to groundwater.

Source: https://www.epa.gov/waterreuse/maps-states-water-reuse-regulations-or-guidelines

Google

amazon

Meta

and more…

Goals - Water

Sustainability
Environmental, Social & Governance (ESG)

Technical Challenges

// Drivers for Treatment and Reuse

Eliminate/Minimize Discharge

- Prevent/minimize discharge of wastewater to local WWTP/POTW.
- Reduce strain on municipal WWTP (high flows and unique constituents)
- Reduce impact on waterways

Resource Recovery and Sustainability

- Reduce potable demand/community impact
- Support future expansions
- Increase resiliency

// Cooling Options are Limited

- Air cooled chillers at datacenters work, but...
  - More energy intensive/less efficient
  - Larger footprint per BTUh/sq. ft. of cooling capacity
- Advantages
  - Uses outside air when temperatures are optimal
  - No concerns with biological growth/Legionella
  - Very low water usage

// Evaporative Cooling is The Preferred Option

- Datacenter cooling systems typically have high water demand.
  - 100-megawatt Datacenter will have an average water demand of ~1.1 MGD
- Cooling Tower Blowdown
  - Seasonal variations
  - Peak blowdown up to 2x average demand
- Cycles up raw water constituents:
  - Salts
  - Hardness (Ca, Mg)
  - Metals
  - Polyfluorinated Compounds (PFAS)
  - Nutrients
- Chemicals in Cooling Towers:
  - Biocides
  - Corrosion inhibitors

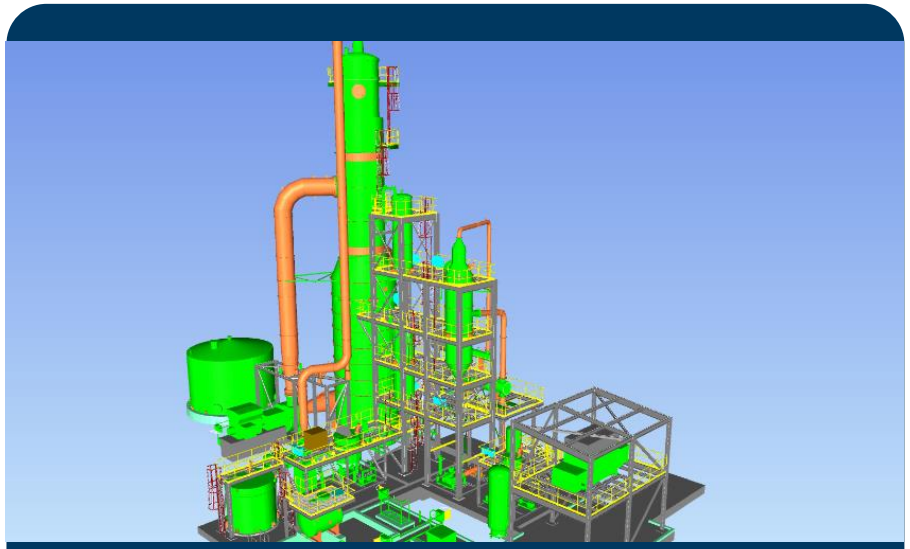
// Treatment Challenges for Reuse of Cooling Tower Waste

- Technical
  - Wastewater streams need to be segregated
    - Keep sanitary wastewater separate from cooling tower blowdown and treatment
  - Removal of dissolved solids (TDS) results in salt concentrate (reject)
  - Water reuse can cycle up hard-to-treat constituents (i.e., PFAS in reclaim makeup water)

- Permitting can be challenging and lengthy.
  - New treatment processes for the utility/agencies
  - Limited reclaim/reuse regulatory framework for cooling applications

Potential Solutions (Case Studies)

// Case Study - Reuse Provides Partnering Opportunities



Southwest Data Center Reuse with ZLD

LESSONS LEARNED

Partnership and clear policy negotiation early in the process is critical to success

- Multiple industrial clients in partnership with a regional entity
- AWTF privately funded/operated
  - Serves one customer, but relies on shared infrastructure (by others)
- Other infrastructure jointly funded, which adds complexity
  - Shared capital costs (reclaimed water infrastructure)
  - Shared O&M costs (reclaimed water distribution)
  - Pretreatment facilities and contractual reclaim water quality requirements

// Case Study – Partnering through a Design/Build/Transfer Model

Major Social Media Company Funds Design and Construction

LESSONS LEARNED

Engage the Local Municipality Early and Often. Design to Owner's Standards

- Single data center in remote location within municipal service area
- Treatment facility funded by customer
- Facilities will be transferred to the local utility to operate and maintain
  - Design consistent with municipality's standards
  - Redundancy consistent with data center uptime requirements

// Public-Private Partnering Opportunities are a Way to Support Future Community Sustainability

- Both municipal and industrial water users are placing an increased emphasis on the **value** of water
  - Creates private financing opportunities
- Water resource and treatment challenges are complex
- Permitting continues to evolve

Partnering provides communities with options to solve their financing, technical, and operational challenges, which can minimize impact to the community.

Questions?

If you have questions, please contact:

Brandon Yallaly
byallaly@carollo.com

Darcy Sachs
dsachs@carollo.com