



Data Centers and Green Computing

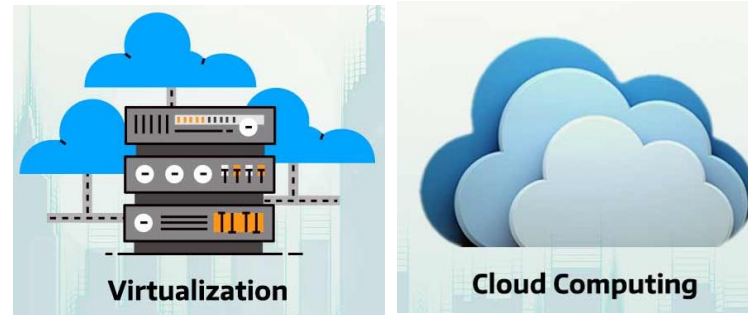
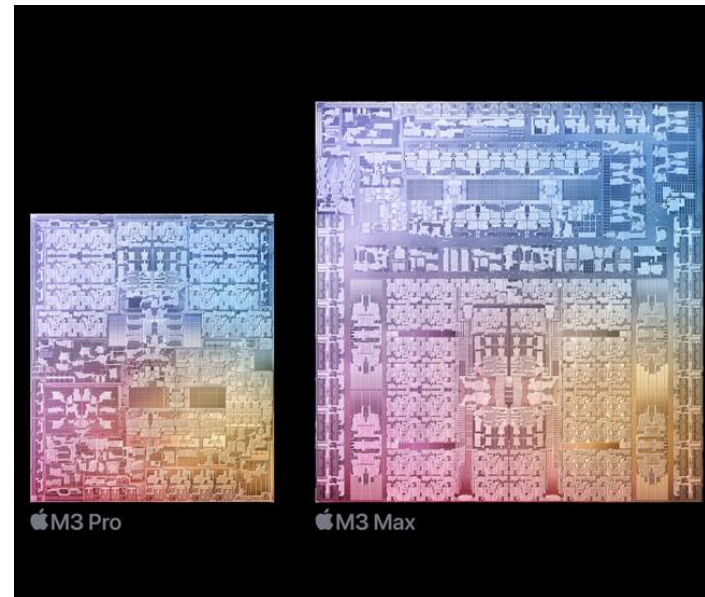
Harrison Hensley
BAIS 550



What is Green Computing?

“Practices and technologies for designing, manufacturing, using, and disposing of computers and other IT equipment in order to minimize impact on the environment”

- Recycling/minimizing E-Waste
- More efficient code
- Virtualization/Cloud
- Efficient Chips
- Refurbished Electronics



the Top 3 Refurbished Electronics Marketplaces

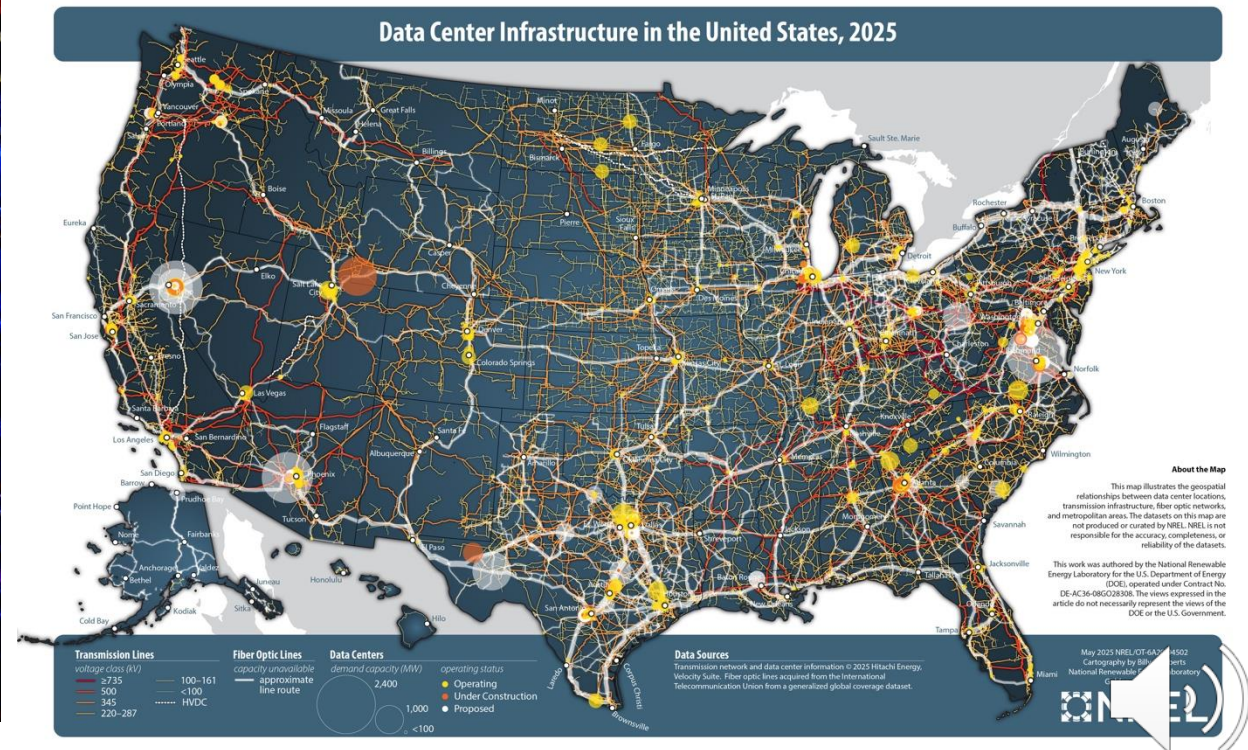
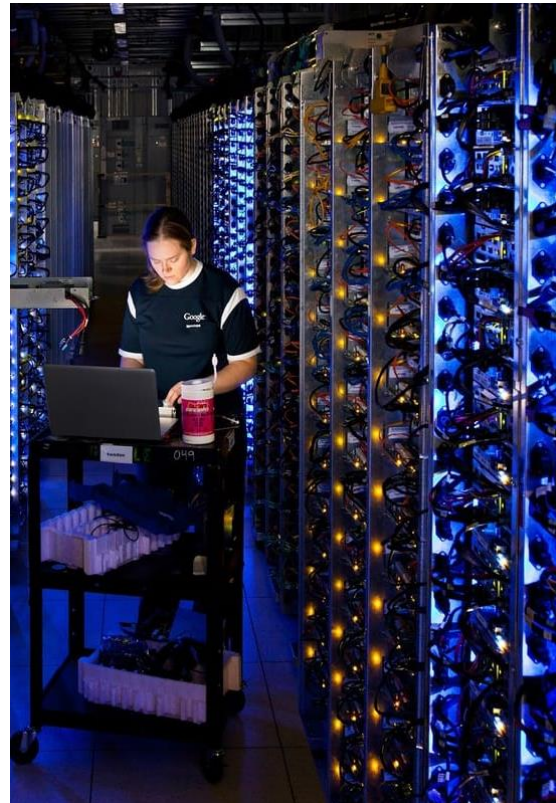
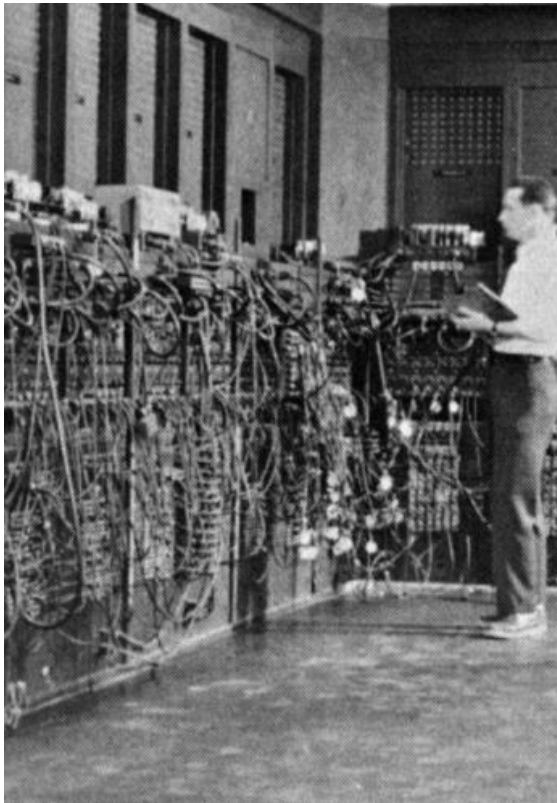


```
ws.on("message", m => {  
  let a = m.split(" ")  
  switch(a[0]){  
    case "connect":  
      if(a[1]){  
        if(clients.has(a[1])){  
          ws.send("connected");  
          ws.id = a[1];  
        }else{  
          ws.id = a[1]  
          clients.set(a[1], {client: {pos:  
            ws.send("connected")  
          }  
        }else{  
          let id = Math.random().toString()  
          ws.id = id;  
          clients.set(id, {client: {pos:  
            ws.send("connected")  
          }  
        }  
      }  
    }  
  }  
})
```

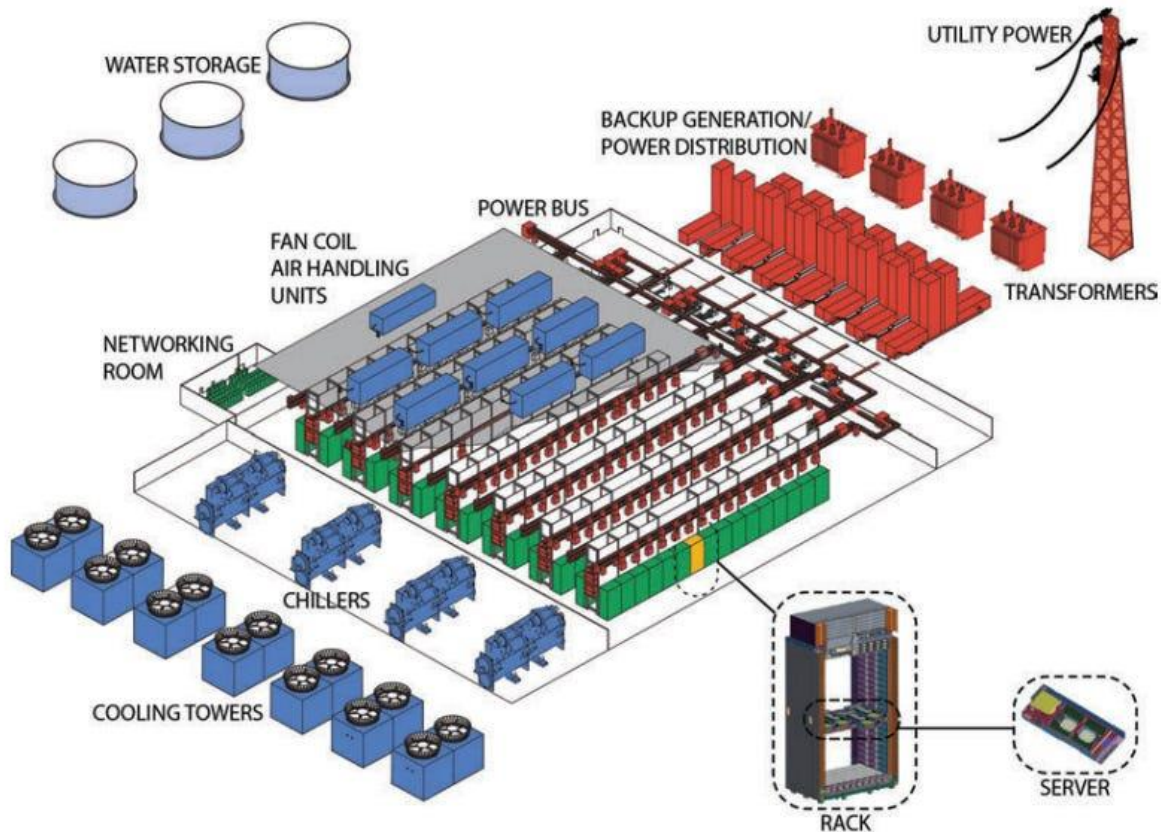


What are Data Centers?

“Facility that houses computer systems and associated components such as telecommunications, storage, security systems, and backup power supplies”



Data Center Infrastructure



Servers

Storage

Networking

Power Supply

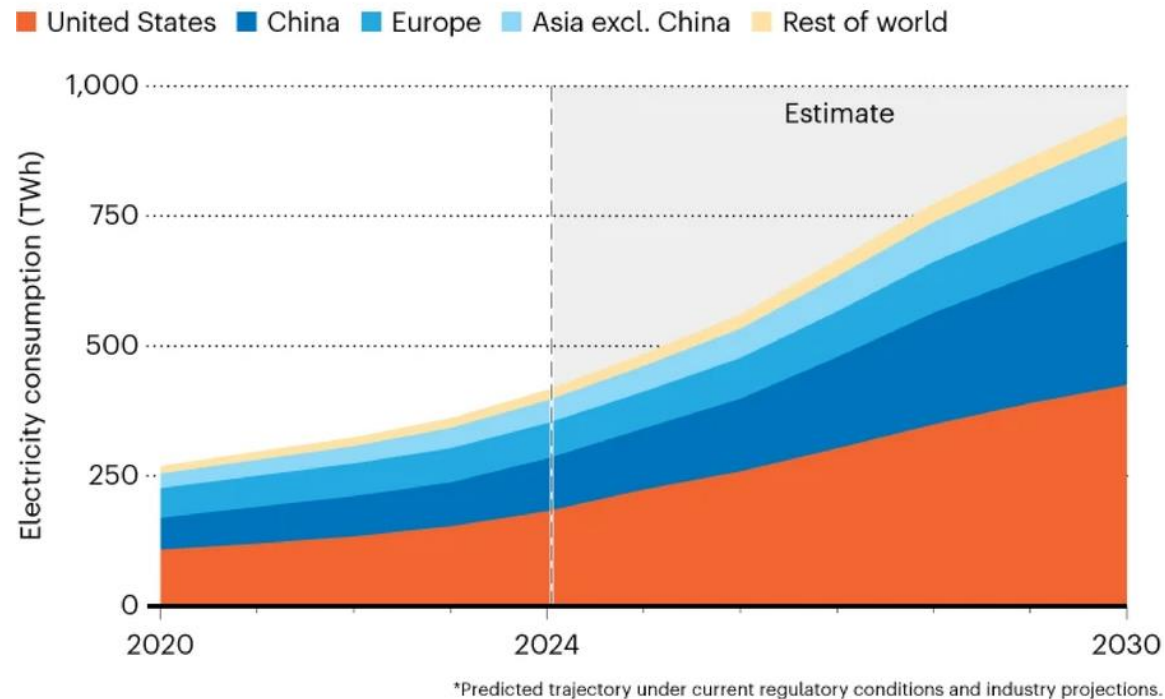
Environmental Monitors and Controls

Redundancy Measures



How are they related?

- Data centers use a lot of resources
- AI is driving more demand than ever
- Climate Change and Consumer Preference



 The Independent

AI is terrible for the environment, study finds

The researchers suggest that the impact of those emissions could be vast. AI-related emissions could cost the industry more than \$10 billion...

Nov 8, 2024



Methods for Green Data Centers



DCIM Software for Measuring and Monitoring

- Set KPIs
- Audit
- DCIM Software



$$CUE \left[\frac{\text{kgCO}_2}{\text{kWh}} \right] = \frac{\text{Data Center Total CO}_2 \text{ Emissions}}{\text{IT Equipment Energy}}$$

$$PUE [-] = \frac{\text{Total Data Center Energy}}{\text{IT Equipment Energy}}$$

$$WUE \left[\frac{1}{\text{kWh}} \right] = \frac{\text{Data Center Water Consumption}}{\text{IT Equipment Energy}}$$



Hardware Solutions

Example: Networking Switches



Arista 7280R3



Cisco Nexus 5548UP

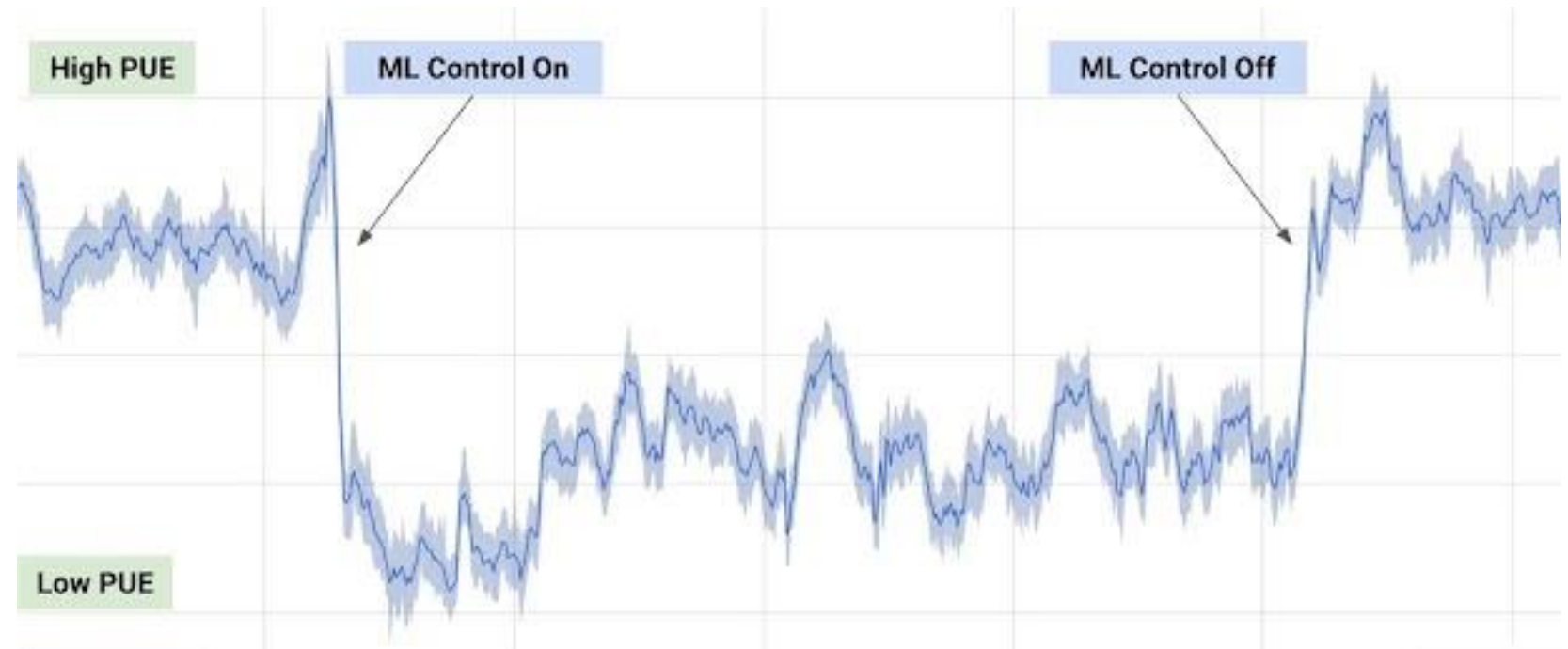
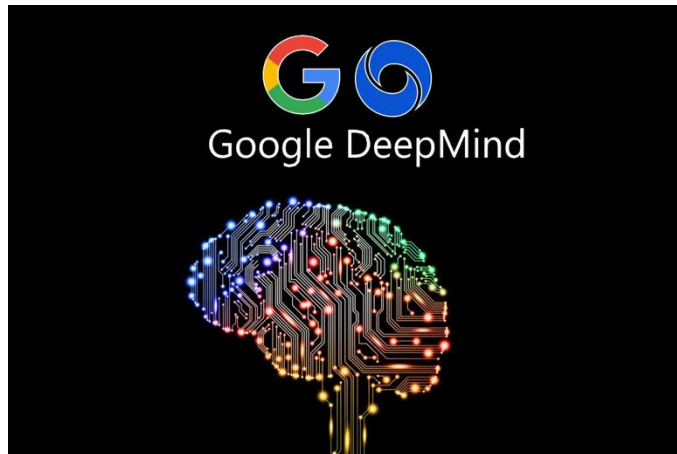


Arista consumes 66% energy



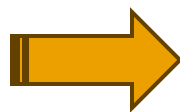
Software Solutions

Example: Google's DeepMind



Energy Sources

- #1 Today: Coal and Natural Gas
- Renewables: Solar and Wind
- Nuclear
- Backup: Diesel to Fuel Cell



Pennsylvania Capital-Star

Microsoft describes Three Mile Island plant as a once-in-a-lifetime opportunity

The plant's reopening will support at least 650 permanent jobs and hundreds of other positions during the recommissioning process.

Jun 25, 2025



Reuters

Google announces Tennessee as site for small modular nuclear reactor

Google, with Kairos Power, has selected Tennessee as the site of an advanced nuclear power plant that is expected to supply electricity to...

1 month ago

TechCrunch

Amazon joins the big nuclear party, buying 1.92 GW for AWS

The tech company will power a chunk of its AWS cloud and AI servers using 1.92 gigawatts of electricity from Talen Energy's Susquehanna nuclear...

Jun 13, 2025



Cooling Techniques

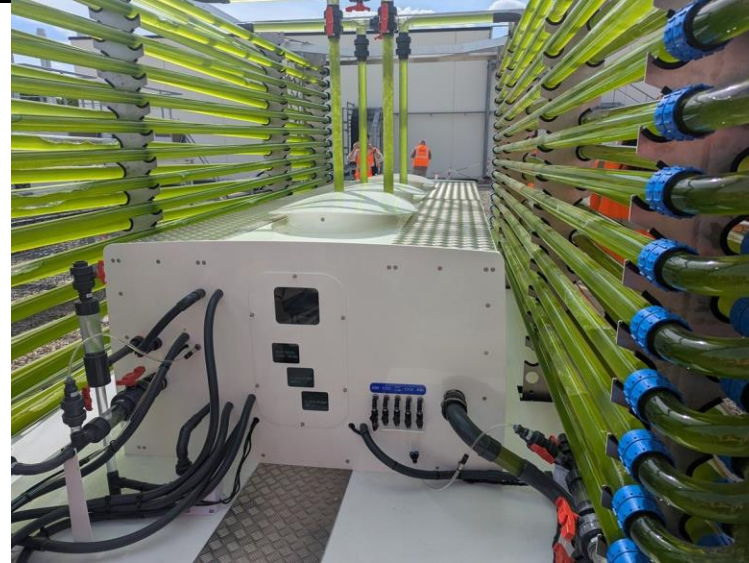
- Liquid Cooling/Immersion
- Direct-to-Chip
- Free Cooling



Future of Cooling



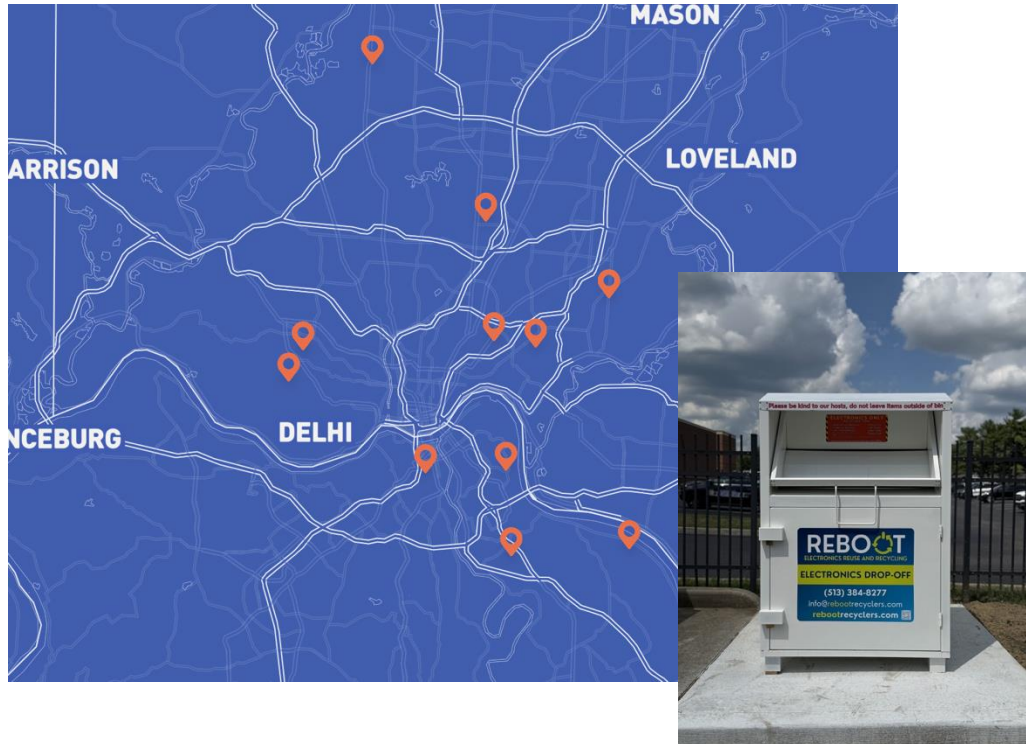
Data centers under the ocean
and in space



Algae as
coolant



What can you do?



Discussion Questions



If you were building a data center and choose the energy source, which would you pick?

Do you think there will be a net benefit to AI when it comes to the environment or sustainability?

Do you think we will see data centers in space in our lifetime?

What are ways you personally or your company can improve when it comes to green computing?



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