Data Centers as Large Loads

Educational Overview

DATA CENTER COALITION

Data Center Coalition (DCC)

- **Voice** of the U.S. data center industry
- **Advocates** for a business climate, policies, and investments that support the growth and competitiveness of the industry
- **Information Resource** for elected officials, regulators, utilities, grid operators, community leaders, and other stakeholders

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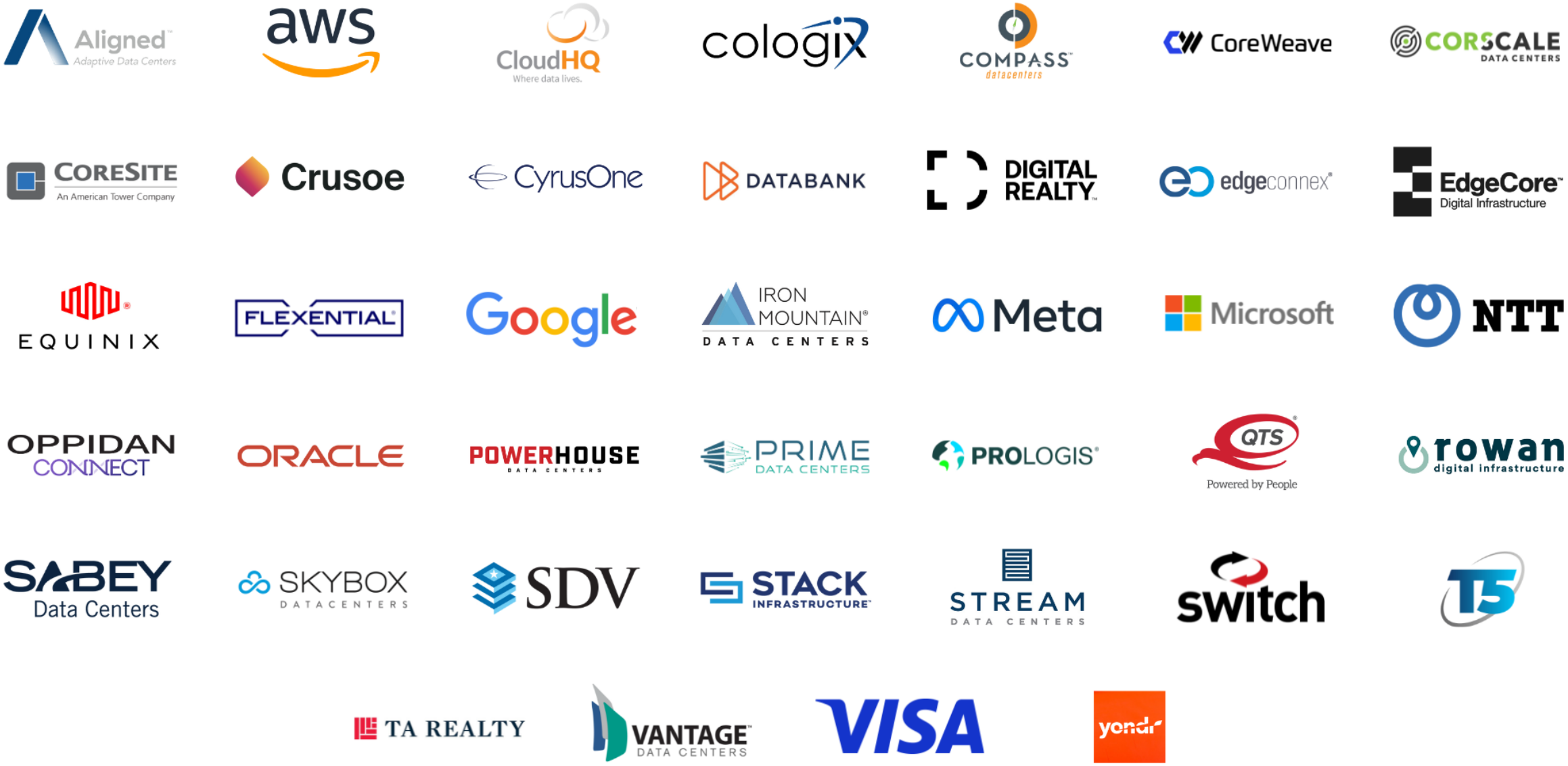
DCC members are leading data center owners and operators, as well as companies that lease large amounts of data center capacity.



Background

- Data centers are the backbone of modern society—powering national security, healthcare, finance, communications, and the digital tools we rely on every day.
- DCC members are committed to reliability and actively support new generation and grid solutions in PJM.
- PJM's large load proposal has implications that should be understood in the context of **operational realities and commercial processes**.

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Main Types of Data Centers

- The data center industry is not monolithic
  - Diversity in companies, company sizes, business models, missions, and types of computing operations
- Two main types of data centers:
  - **Self-Perform/Enterprise**
    - Business owns/controls servers and peripherals, may own facility
  - **Multitenant and Build to Suit**
    - Facility owner leases to one or more tenants
- Proposed solutions should recognize diversity in facility profiles, operational realities, and commercial processes.

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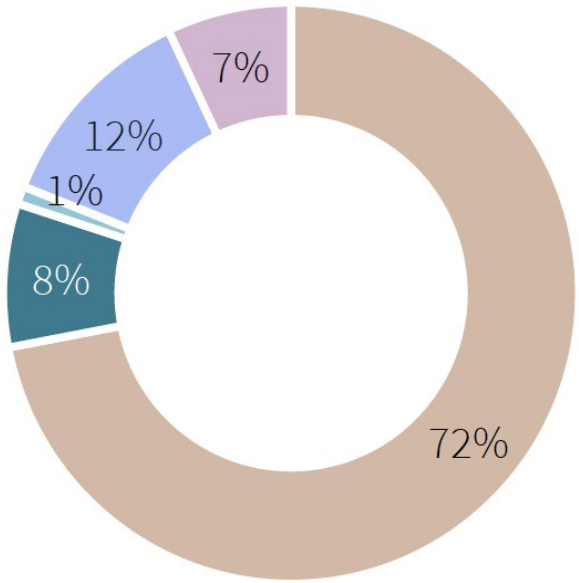
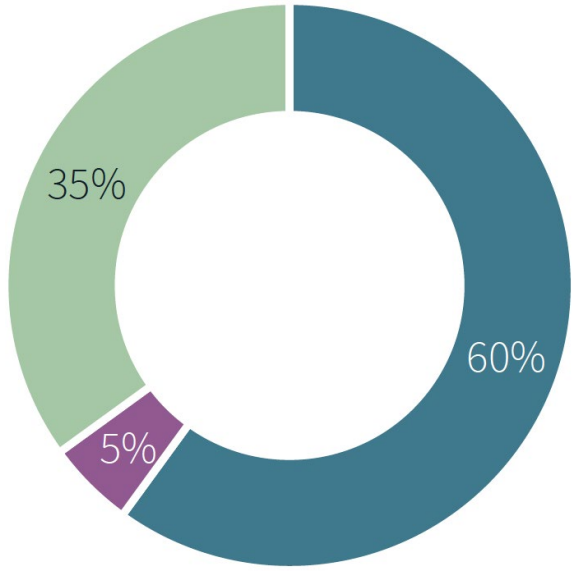
User Demand by Industry Varies Across Markets

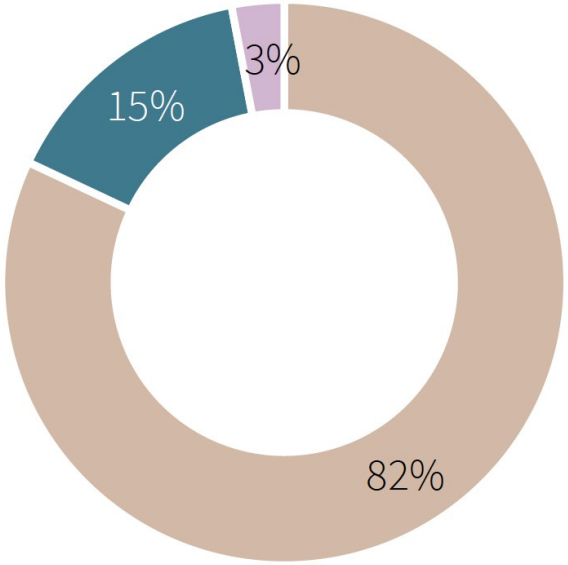
Chicago



New Jersey



Northern Virginia



Source: JLL, North America Data Center Report, H2 2023, https://www.us.jll.com/content/dam/jll-com/documents/pdf/research/americas/us/jll-north-america-data-center-report-h2-2023.pdf

Data Centers Are Fundamental to Our Modern Economy

- National security, military, and emergency response
- Local, state, and federal government operations and services
- Cloud computing, AI, and machine learning
- Healthcare, telehealth, medical records, and research
- Online banking, stock transactions, payment processing, and e-commerce
- Business applications and connected devices (IoT)
- Grid management and energy solutions
- Remote work, online learning, and global communications
- Transportation (land, air, sea), connected and autonomous vehicles
- Video streaming, gaming, and digital entertainment
- Driving the next wave of innovation

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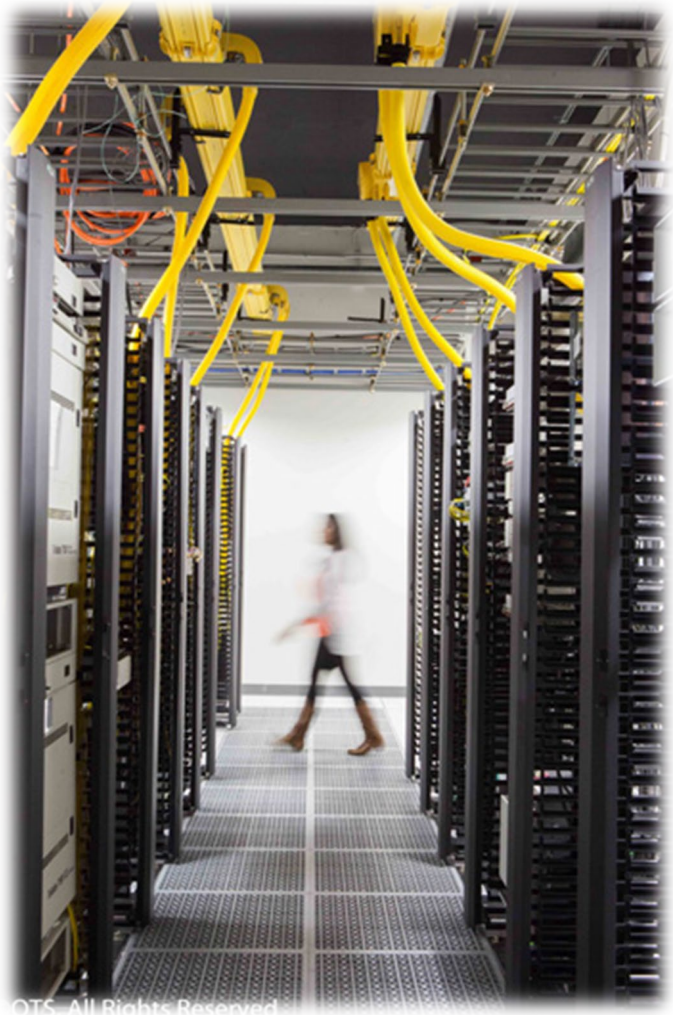
Inside a Typical Data Center

- Building Shell
- Interior Space
- Security
  - Exterior
  - Interior
  - Cyber
- Servers
- Fiber/Networking Connectivity
- Reliable Power 24/7
  - Grid & Emergency Backup Generation
- HVAC/Cooling

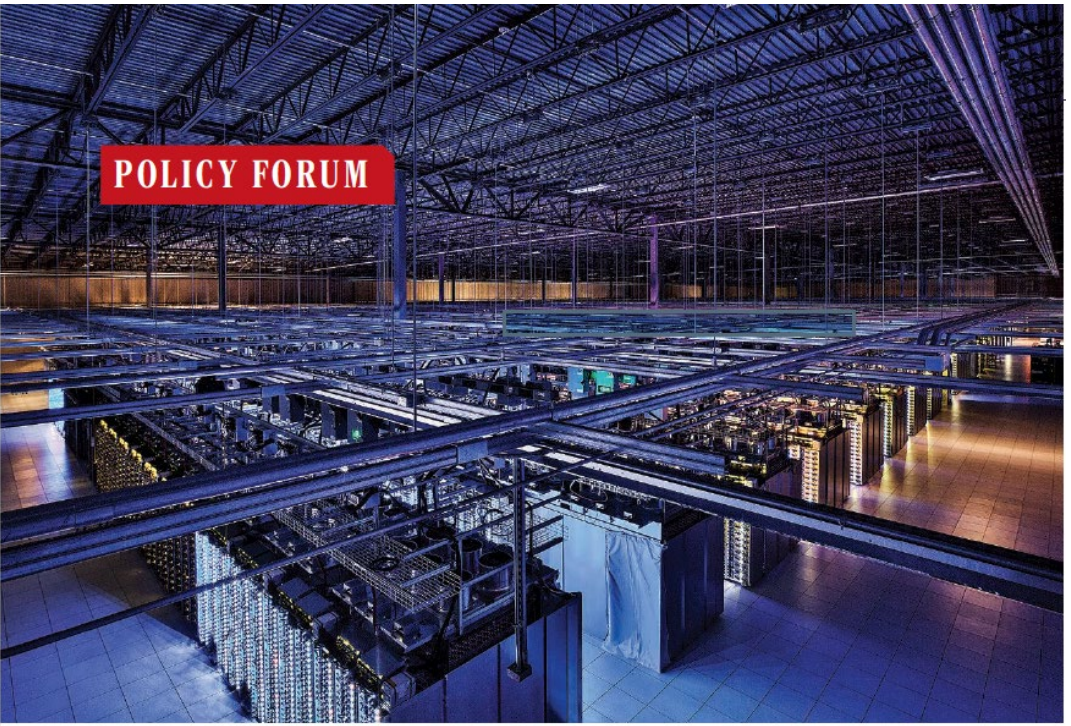


Commercial Development: Multi-Tenant Example

Varied and variable development cycles lead to years of work prior to energy consumption

1. Key steps from bare dirt to commissioned data center
   - Entitlements
   - Fiber
   - Construction
   - Utilities
2. Customer contracts are generally tied to commencement date: Fully built, commissioned, powered space
3. Data centers, utilities, and regulators must plan for years in advance of signing contracts
4. Customer usage ramps up from initial powered space
   - Actual usage is determined by end customer(s)
   - Fit up is done in chunks as inventory to sell is balanced with signed and pipeline contracts
   - Contracts within the fit-up can be phased
   - Deployment of servers are phased by the customer

Data Centers Are Highly Efficient Consumers of Energy



ENERGY

Recalibrating global data center energy-use estimates

Growth in energy use has slowed owing to efficiency gains that smart policies can help maintain in the near term

- Data centers provide greater efficiency and security with computing
  - While energy consumption by data centers rose 6 percent from 2010 to 2018, **computing output jumped 550 percent.**
- Incentivized to pursue energy efficiency to lower operational costs and ensure cost-competitiveness
- Enable efficiencies and energy savings for all customers economy-wide
  - Smart thermostats, smart meters, demand response, managed EV charging, grid enhancing technologies, wildfire monitoring technologies, etc.

Source: Science, Recalibrating global data center energy-use estimates, Feb 28, 2020. https://www.science.org/doi/10.1126/science.aba3758 and https://datacenters.lbl.gov/sites/default/files/Masanet_et_al_Science_2020.full_.pdf

Backup Generation Considerations

- On-site backup generation is typically diesel generators due to fuel availability, cost-effectiveness, workplace safety, and dependability.
- Backup generators are sited as an emergency resource to ensure continuity of data center operations during grid outages – not as a callable resource.
- Proposing or requiring expanded use of on-site diesel backup generators raises several issues:
  - State and federal air permitting rules and regulations
  - Local regulations and noise ordinances
  - Good neighbor considerations (i.e. noise, emissions impacts) in communities where data centers are located
  - Industry sustainability commitments
  - Available fuel supply, delivery, and price impacts
  - Not all data centers have 1:1 backup generation

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Flexibility Considerations

- DCC supports exploring additional *voluntary* demand response programs in PJM that properly allocate risk, incentivize (or compensate for) participation, and allow customers to meet their sustainability commitments.
- It is important to ensure that the desire for greater flexibility does not supersede reality
  - **Data centers are not monolithic** and proposed solutions cannot be one-size-fits-all.
  - Many data centers require a high level of availability for operations or meeting contractual commitments – typically 99.999% up time.
  - Some data center workloads are latency-sensitive and cannot be shifted without service disruption.
  - Critical to distinguish between what's technically feasible versus commercially viable and scalable.
  - Potential strategies will vary by facility, operations, and likely differ in the near- and long-term.
  - Ongoing initiatives exploring flexibility

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Challenges with Characterizing Computing Workloads

- Data centers can serve a variety of functions or customers within the same facility, behind a single meter.
  - Computing workload distinctions or characterizations do not align with data center operations
  - This is especially true for multi-tenant data center companies that have multiple tenants within a given facility.
- One operational reality that makes it difficult to determine **what portion of load is "exemptible"**

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Building Greater Forecasting Confidence with Large Loads

- Commercial readiness verification for large load additions
  - Site control, service agreements, permitting progress, understanding of financial commitments, proven track record of development, etc.
- Transparency of forecast inputs and assumptions
- Reporting standardization across utilities (where possible)
- Supplement forecasts with independent/third party data
- Regular forecast review and backcasting analysis

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Supporting Grid Reliability through Workable Solutions

- Data centers are not just load – they are **active market participants**.
- DCC members are signing **PPAs and supporting new generation** in PJM.
  - Industry investments and announcements for nuclear, thermal, renewables, storage
- DCC aims to work with PJM and other stakeholders on **shared solutions** to meet regional reliability needs.

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Key Takeaways

- Backup generation is not a panacea.
- Flexibility will depend on the facility, computing operations, and program design.
- Computing workload distinction is not feasible at the meter level.
- DCC members are investing in new generation and reliability solutions.
- Proposed solutions at PJM must reflect the commercial and operational realities of data centers that are essential to our daily lives, modern economy, and national security.

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Questions?

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