Data Centers as Flexible Grid Assets

Data Center Flexible Load Initiative

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Outline

- Data center energy use & grid impact
- Demand flexibility opportunities
- EPRI's DCFlex Initiative
  - Defining Flexibility
  - Demonstrating Resource Capabilities
  - Evolving the Utility-DC Engagement

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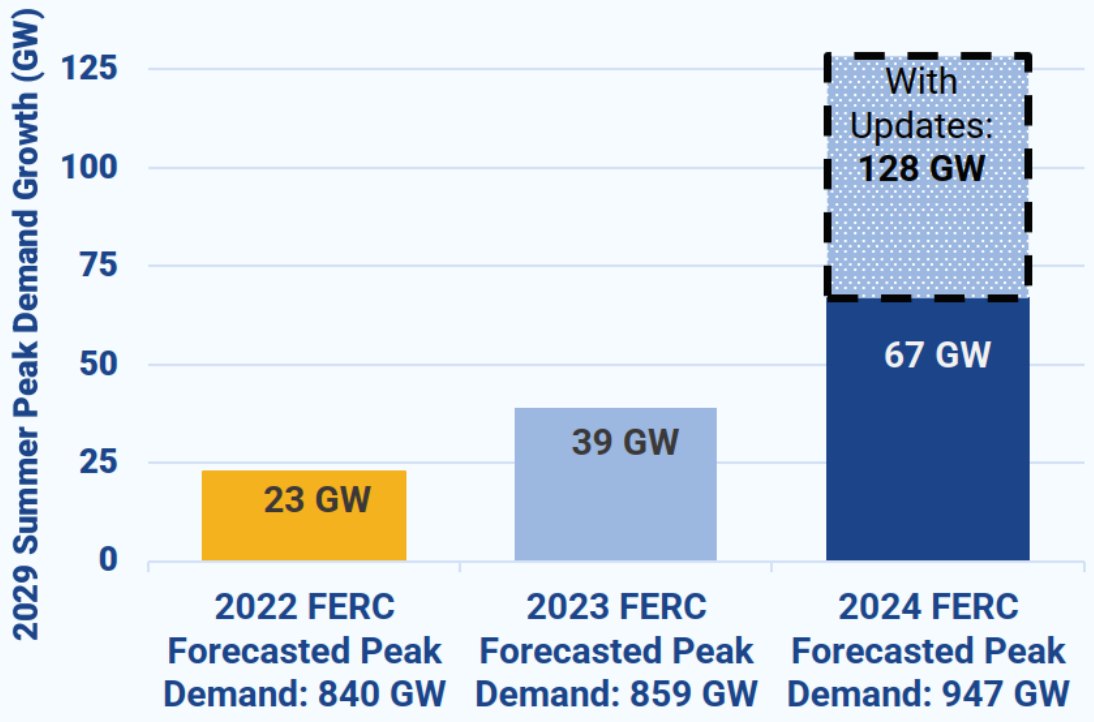
“The Era of Flat Power Demand is Behind Us”

- Grid Strategies, Dec 2024

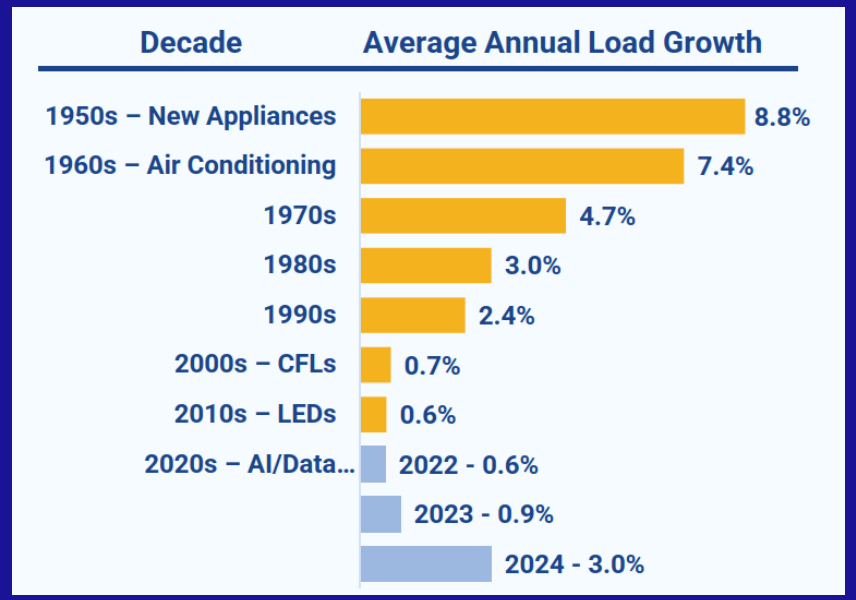
Load growth to add 128 GW peak demand by 2029



Source: Grid Strategies National Load Growth Report 2024

“Electricity is a bull market for the first time in decades”

- Semafor, Mar 2024



Grid Strategies 2024

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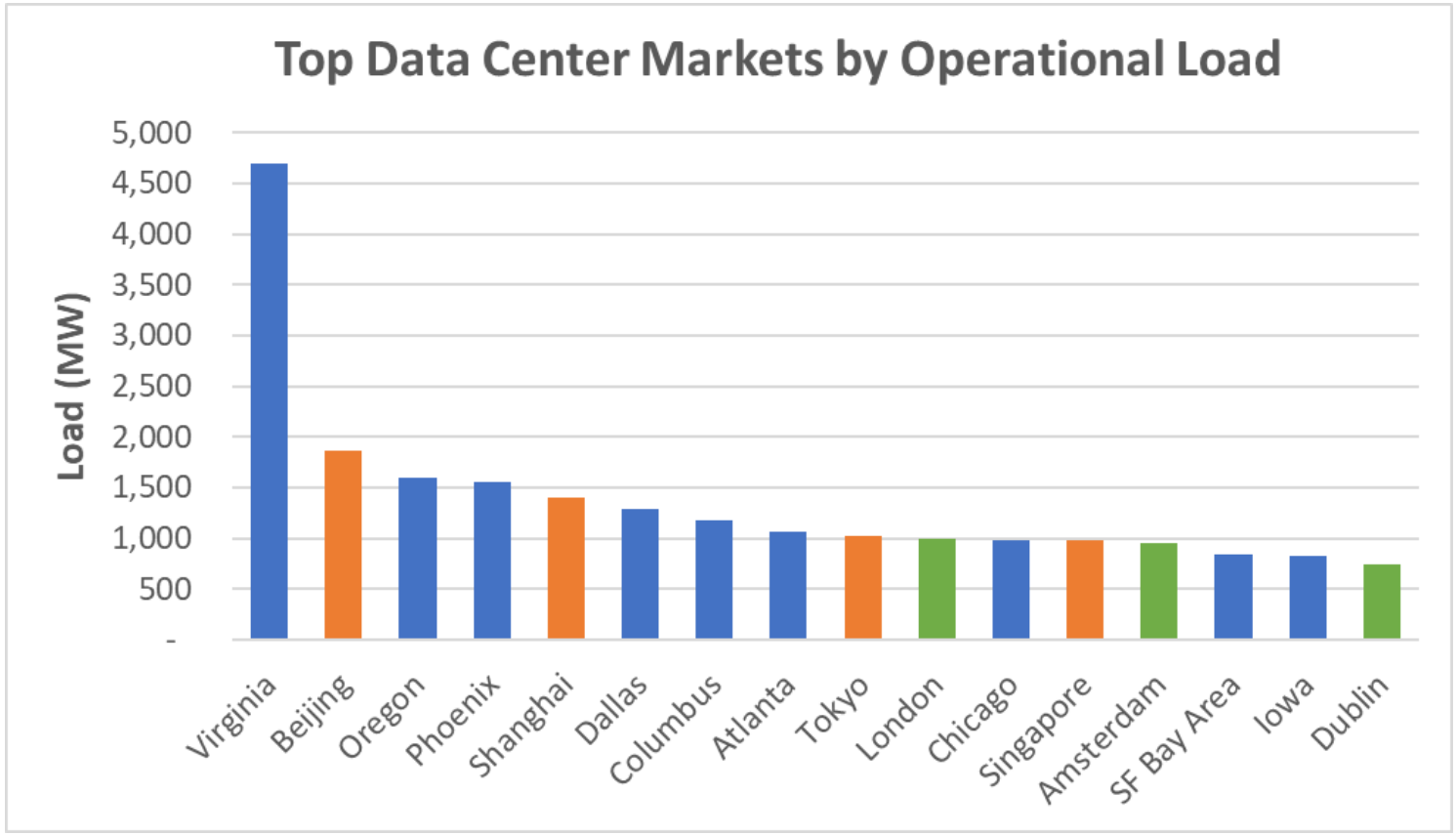
Data Center Growth is Straining Grid Capacity in Certain Regions



Site selection criteria:

- Power availability
- Local tech market
- Fiber connectivity
- Costs (land, taxes, power)
- Renewable energy options

SF Bay Area remains a core data center market

Source: Cushman & Wakefield Data Center Market Comparison (2024)

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Large Flexible Loads could Unlock 100 GW of US Grid Capacity

- Duke University, Feb 2025

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Demand Flexibility in Data Centers

Backup generators

- Limited by local emissions regulations in some jurisdictions

UPS

- Li-ion UPS can provide grid services (frequency response)
- Voltage ride-through and ramp rate control

Load flexibility

- Some processes can be scheduled for off-peak hours (backups, updates, etc.)
- Dynamic load transfer to another data center

Opportunity in AI?

- How much flexibility offered by AI model training?

Microsoft's Dublin DC uses Li-ion batteries to support growth of renewables on the grid

Texas crypto miner Riot Platforms made $32M from DR participation in August 2023
(~3.5x the bitcoin mined)

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Objective: Demonstrate how data centers can support and stabilize the grid while improving interconnection and efficiency.

WS1: Flexible Data Center Designs

Enabling future data centers to become grid resources through flexible & efficient designs and operational practices

WS2: Transformational Utility Programs

Explore market & program structures that advance data center flexibility

WS3: Grid Planning for Operational Flexibility

Equip the utility industry planning practices to embrace large flexible loads

WS4: Data Center Informed Energy Supply

Inform energy supply portfolio needs and readiness

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Today's Challenge

What Flexibility is Available?

What Flexibility is Needed?

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Today's Challenge

Grid Planner / Operator

- How much flexibility is available?
- Can it be relied upon?
- Can we offer viable flexibility programs?

What Flexibility is Available?

What Flexibility is Needed?

Data Center

- How is flexibility accounted for and how much is it worth?
- Does flexibility enable faster connection?
- Do the business impacts outweigh benefits?

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Demonstration Projects

- Real-world testbed of flexibility capabilities
- Evaluate & characterize response by resource / asset
- Independent M&V with high-resolution metering
- Test events to represent grid needs today & in future
  - Advance notice (day vs hours vs min) & event duration

- **Target:** 10 demo sites (US & international)
- Variety of business models: hyperscale, colocation, AI

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Demonstration Selection Update

13 projects proposed, 3 confirmed

	Load Flexibility (AI)	Load Flexibility	Power Quality
Location:	Phoenix, AZ	Lenoir, NC	Paris, France
Demo:	AI Workload Flexibility	Cloud Workload Flexibility	PQ Fault Ride-Through
Utility:	APS, SRP	Duke Energy	RTE
Partners:	Emerald AI, NVIDIA, Oracle	Google	Schneider Electric, Data 4

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Questions?

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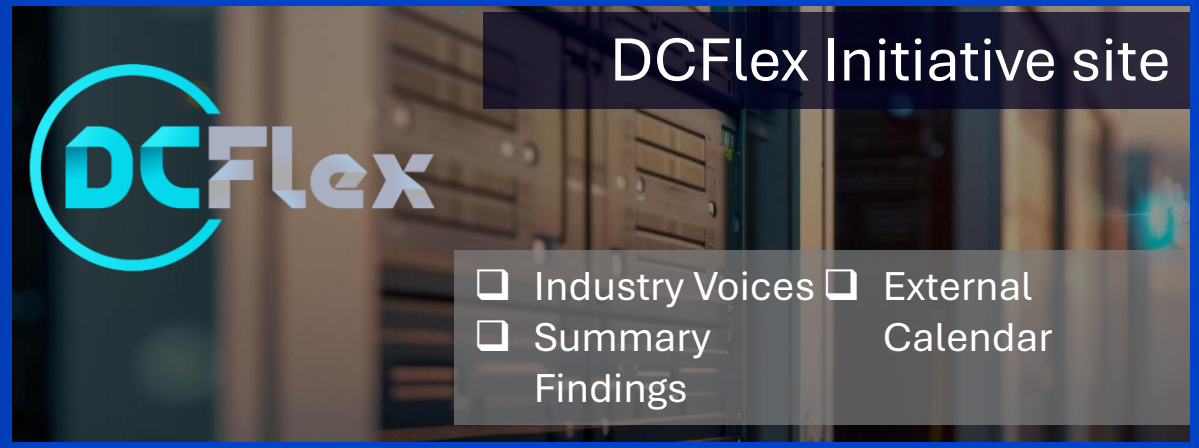

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