LAS Meeting

July 13th, 2026

Charles River Associates

Meeting Agenda

Topic	Timing
Introductions	9:15 – 9:25 AM
Data Collection, Validation, & Integration	9:25 – 9:40 AM
Top-Down Forecast	9:40 – 10:00 AM
Bottom-Up Forecast	10:00 – 10:20 AM
Forecast Reconciliation	10:20 – 10:35 AM
Uncertainty & Hourly Forecast	10:35 – 10:45 AM
Break	*10:45 – 10:55 AM*
Q&A	10:55 – 11:55 AM
Next Steps & Close	11:55 – 12:00 PM

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Today's Presenters

Project Director
Margarita Patria, PhD

Project Manager
Oliver Stover, PhD

CRA is a leading consulting firm that offers economic, financial, and strategic expertise to major law firms, corporations, and governments globally

Key Facts

60+

Years advising clients, founded in 1965

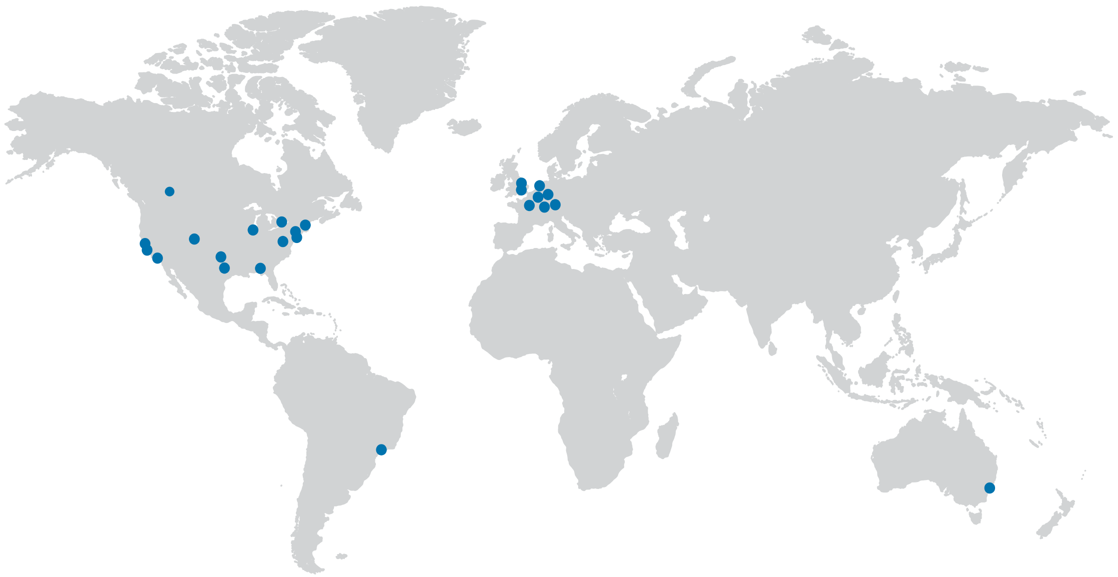
1,000+

Consultants and extended network of senior experts

24

Offices in 10 countries across various industry practices

International Office Locations and Presence



Boston - New York - Summit NJ - Washington DC - Tallahassee - Chicago
Dallas - College Station TX - Salt Lake City - Los Angeles - Oakland CA
San Francisco - Toronto - São Paulo - Cambridge - Paris - Brussels
Amsterdam - Zurich - Düsseldorf - Munich - Sydney - Calgary - London

CRA provides a defensible, data-rich approach by combining expert internal analysis and third-party ground-level industry expertise

Power Markets, Regulation, & Stakeholder Processes

Market design, tariffs, RA, regulation

Public proceedings, stakeholder engagement, testimony

Load Forecasting and AI-Driven Modeling

Utility planning, IRP, large-load integration

AI/hyperscaler load shapes, hourly demand modeling

Data Center Ecosystem & Strategy

Utilities, hyperscalers, developers, investors

Siting, due diligence, deliverability, market behavior

Infrastructure & System Constraints

Generation, interconnection, transmission,

Labor, equipment, and system readiness constraints

Supply Chains & Manufacturing Constraints

Semiconductors, metals, cables, equipment markets

Critical bottlenecks impacting growth timing and scale

Data Center Design & Operations

Power architecture, facility design

Operational strategy and real-world load behavior

We have assembled a team with deep expertise in data center and other advanced load forecasting, integrated market analysis, policy and regulatory impact, and other key areas impacting data center growth.

CRA will lead the forecast, but we have partnered with specific third-parties (Omdia, CRU) to analyze key elements of the overall forecast.

Statement on Confidentiality and Independence

CRA teams provide various services to many utility and data center clients.

We enforce rigorous screening, staffing, and information separation protocols to ensure that our project teams are independent and unbiased.

We apply strict methodological guardrails to ensure that our forecasts and other work product are transparent, consistent, and as accurate as reasonably possible given the available information. Finally, our teams take conscious and deliberate steps to use **neutral data sources,** to **prevent consultants from evaluating their own clients**, to explicitly link assumptions to avoid double counting, and to reconcile top-down and bottom-up views to ensure the quality of our forecasts and other work product.

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Project Summary

Scope of Work:

CRA will deliver an independent **data center capacity** and **peak demand forecast** for PJM spanning a 2027-2047 horizon with hourly load profiles and explicit uncertainty quantification. This engagement produces a transparent, defensible forecast integrating bottom-up project intelligence with top-down market analysis to support transmission planning, reliability assessments, and resource adequacy analysis.

The methodology combines granular, project-level evaluation using holistic evaluation methodology with structural market modeling of AI growth, semiconductor constraints, and critical material limitations. Analysis addresses emerging configurations including behind-the-meter generation and hybrid supply strategies.

Key Specifications:

Forecast Horizon	2027-2047
Geographic Region	PJM
Methodology	Bottom-up / Top-down
Uncertainty Treatment	Scenario-Based / Probabilistic
Project Timeline	May – October 2026
Targeted Outcome	Hourly Load Profiles

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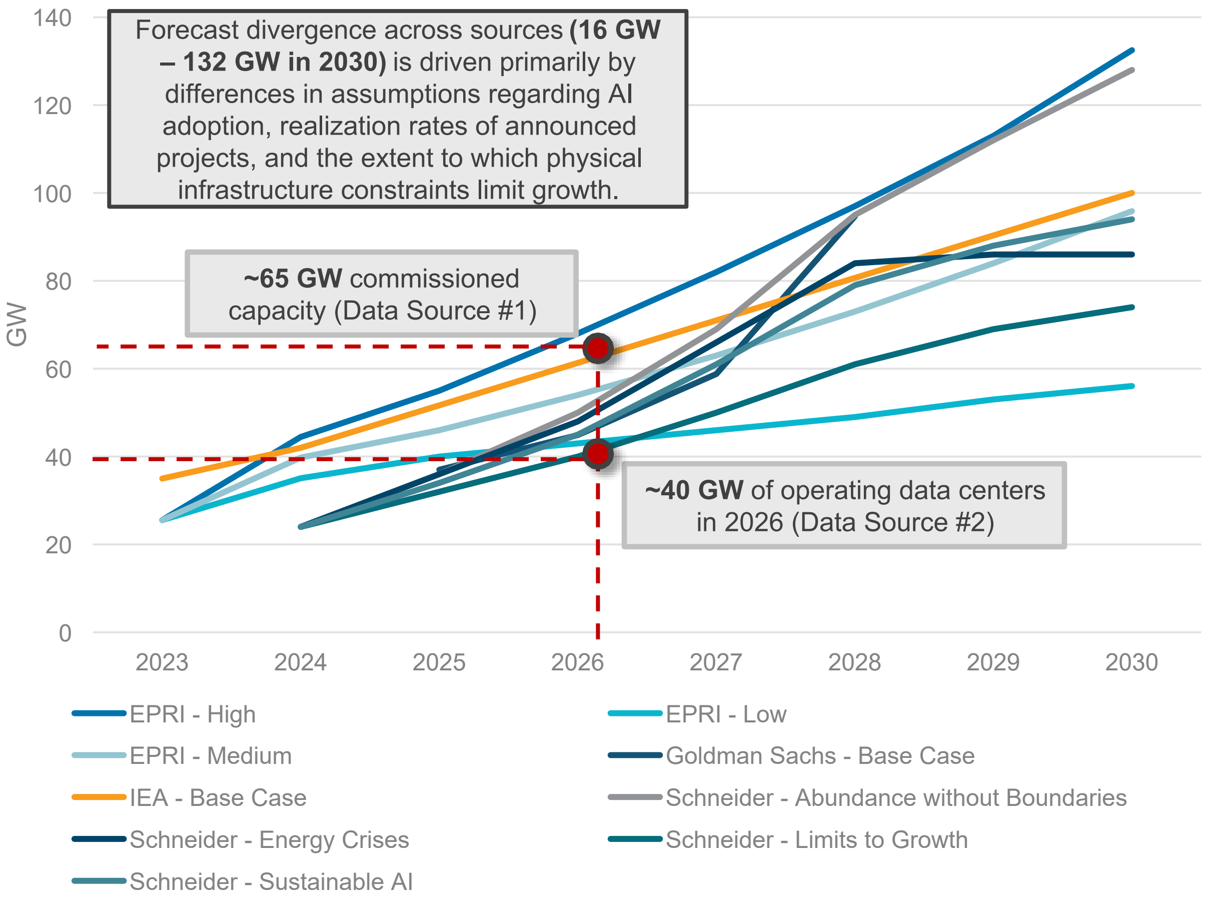
Forecasting data centers is challenging due to variations in assumptions

Key Drivers of Forecast Divergence:

- **Assumptions regarding AI adoption and compute intensity –** Forecasts differ significantly in assumptions regarding the pace of AI adoption, growth of inference versus training demand, GPU deployment, utilization rates, and compute intensity.
- **Assumptions regarding realization of announced demand –** The largest uncertainty in many bottom-up forecasts is how much announced demand ultimately becomes energized load given early-stage projects, land banking, duplicate requests, development delays, and material constraints.
- **Treatment of physical constraints –** Some studies explicitly model infrastructure and power availability as binding constraints on growth, while others focus on equipment, efficiency, and utilization assumptions and treat grid deliverability constraints more indirectly or qualitatively.
- **Differences in methodology and starting point –** Top-down studies often extrapolate from macro drivers such as hyperscaler capex and compute growth, while bottom-up studies build forecasts from project pipelines, utility requests, and observable infrastructure development.
- **Emerging market dynamics are not (fully) incorporated in modeling –** Markets are evolving rapidly, and as new information becomes available across policy, regulatory, and financing dimensions, the question of “how much” load materializes and “by when” becomes increasingly complex. Proactively identifying emerging markets is challenging.

Comparison of US Data Center Capacity Forecasts



CRA Forecasting Guiding Principles

1. **Reflect a Structural Shift in Demand –** This is a new demand era, and recent historical trends should be used as context rather than as a direct predictor of future growth.

2. **Test Demand Against Real-World Constraints –** Forecasts should be grounded in the physical, commercial, and regulatory factors that determine where projects can realistically locate and execute.

3. **Maintain Flexibility and Transparency –** The approach should account for uncertainty, data limitations, and potential double counting, while remaining flexible enough to evolve as market conditions change and transparent enough to explain the rationale behind key assumptions.

Our Ask of You Today:

- **Stress-Test the Forecasting Methodology –** We are open to feedback on the methodology, specifically on factors that are driving/slowing data center growth in your jurisdiction and pushing data center development into new markets.
- **Validate Project-Level Assumptions and Execution Likelihood –** Share what you are seeing from developers and customers, including indicators of project maturity, quality of commitments, duplication across requests, and likelihood that projects will move from inquiry to execution.
- **Identify Jurisdiction-Specific Constraints or Blind Spots –** Flag any local factors that could materially affect timing, location, or scale of load growth, including grid constraints, siting/permitting challenges, policy or regulatory considerations, customer behavior, or other execution barriers.

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Methodology Overview to Produce 20-Year Hourly Load Forecast

1	**Data Collection, Validation, Integration**	Collect site-level data center intelligence and macro drivers for data centers. Create synthesized database by reconciling third-party **data sets with PJM's EDC/LSE submission**.
2	**Top-Down Market & Energy Demand Modeling**	Assess **gross computational demand** to assess how much data center demand could exist based on AI, cloud, enterprise and digital economy growth. Revise demand to account for the share expected to translate into grid-servable data center load after **accounting for constraints that reduce, delay, or relocate growth or drive it behind-the-meter (BTM)**.
3	**Bottom-Up Forecast**	Combine micro, site-level data with local infrastructure and policy dynamics to capture site favorability, based on **siting favorability within PJM zones (and between PJM versus other regions) and the quality, maturity, and credibility of developer activity**.
4	**Top-Down Market, Bottom-Up Reconciliation, and Behind-the-Meter Analysis**	Criteria assessed in the **Bottom-Up** will be aligned with **Top-Down** assumptions. Further, broader macroeconomic assumptions from the **Top-Down** forecast are to be applied to the **Bottom-Up** forecast to allow for more accurate adjustments. Use **BTM configurations** along with decisions to relocate, wait, or cancel projects when the total **Bottom-Up** demand exceeds the constraints reflected in the **Top-Down** forecast. Fill in the **Bottom-Up** pipeline with generic projects if total **Bottom-Up** demand is less than **Top-Down**.
5	**Scenario Analysis & Hourly Forecast**	Use scenarios to define different Top-Down growth trajectories and sensitivities to test how Bottom-Up project assumptions, such as completion probability, timing, and ramp rates, **affect the net load forecast by zone and hourly demand characteristics**.

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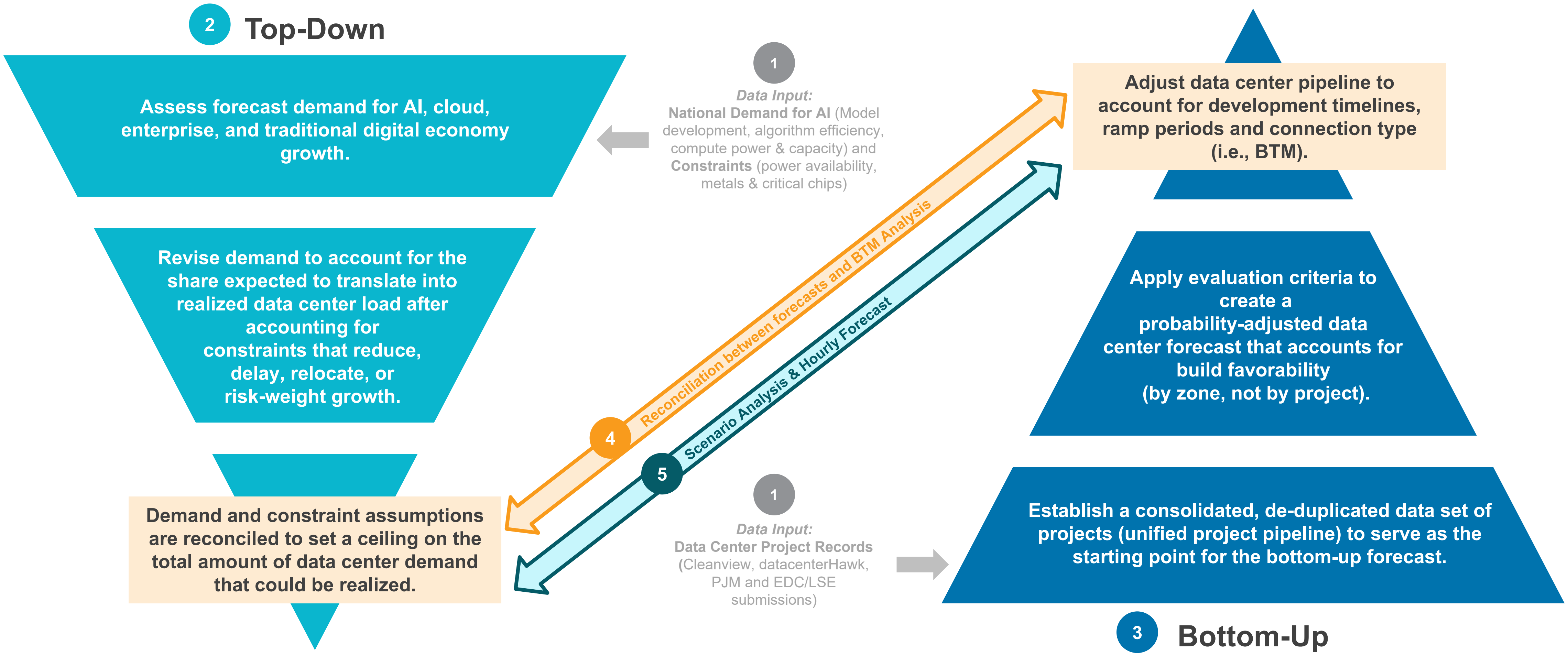
Methodology Overview to Produce 20-Year Hourly Load Forecast *(continued)*



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Data collection, sourcing, and integration methodology overview

Use of Data

- **Unified dataset creation:** Consolidated, auditable dataset integrating multiple third-party sources with PJM EDC/LSE submissions for use as a foundation.
- **Source prioritization:** Source strengths weighted to ensure consistency and completeness.
- **Dual-purpose design:** Supports project inventory for the Bottom-Up forecast and market-level assumptions for Top-Down forecast.
  Key Inputs:
    - *Top-down:* supply chains (e.g., semiconductors, generation, critical materials)
    - *Bottom-up:* project-level, BTM, and EDC/LSE data

Governing Practices

- **Neutral data inputs:** Reliance on independent, publicly available, and non-biased sources.
- **Relationship mapping and de-duplication:** Link projects, developers, and customers to prevent overlap and ensure consistency.
- **Data validation layer:** Consistency checks, gap analysis, and local market insights to enhance dataset quality and completeness.
- **Internal governance and QA/QC:** Standardized definitions, documented assumptions, version control, and structured review procedures before data is used.

Sources of Data (3rd-Party):

Project-Level Developer

Cleanview

Behind-the-Meter

DATACENTER HAWK

Data Center Real Estate

Double Counting and Correlated Risk

A number of issues can potentially overstate pipelines, including:

	Proposed Solutions
Pipeline mistakes: Projects mistakenly included twice as individual and as a campus.	*Identify very similar projects and maintain a clean, disciplined data pipeline.*
Campus optionality: Announcements bundle phased loads. The first building has a higher probability of completion; additional buildings may have lower probability.	*Split phases into separate projects and evaluate them separately on the Bottom-Up evaluation matrix (signed ESAs rated higher, earlier phases lower) and link them in modeling so Phase B only happens if Phase A does.*
Land optionality: Developers buy multiple parcels in the same market to hedge permitting risk and gain utility negotiation flexibility.	*Capture the stage of development. Nascent projects are unlikely to proceed if the market faces constraints but offers critical optionality for development barriers at individual sites.*
Adding realism: Individual market, zonal, and LSE/EDC forecasts can add to a total that exceeds physical limits.	*Perform a Top-Down forecast that considers explicit infrastructure limits at the national, market, zonal, and EDC/LSE level.*

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Top-Down Forecast Approach

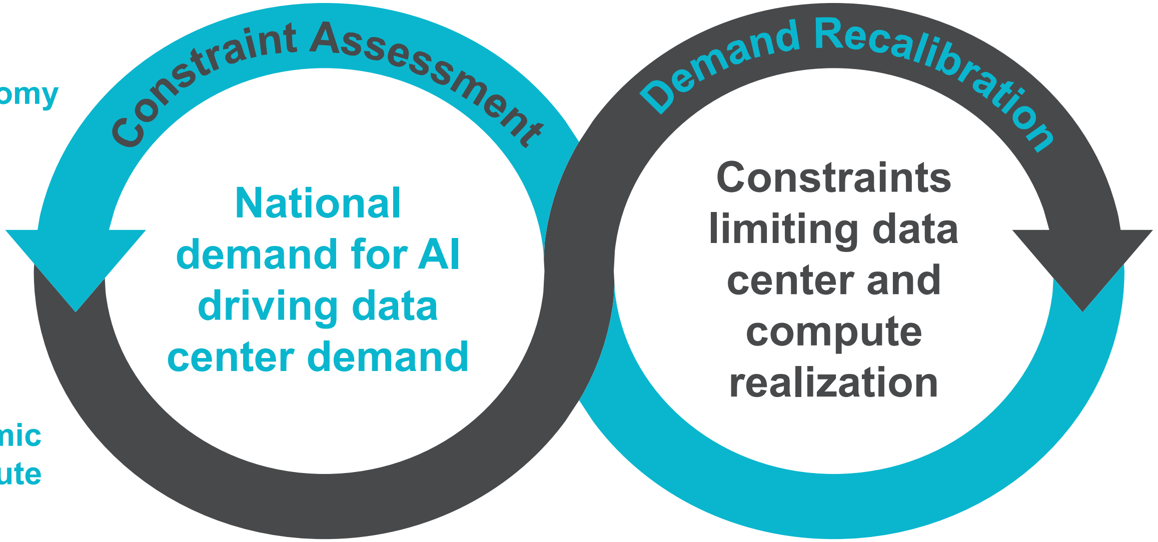
Convert national data center demand into realistic regional load forecasts by accounting for constraints that impact how much growth can realistically materialize

Traditional digital economy

AI model development

Algorithm and chip efficiency

AI-embedded economic activity/inference compute



Physical constraints: metals, chips, battery materials

Power constraints (including turbines)

Compute capacity

Constraints reshape growth trajectories; investment in efficiency improvements and relaxed binding constraints when demand is not met

Regional Allocation: supply/demand, speed-to-power & utility readiness, infrastructure availability, regional competitiveness, etc.
Aligned with Bottom-Up Evaluation Criteria

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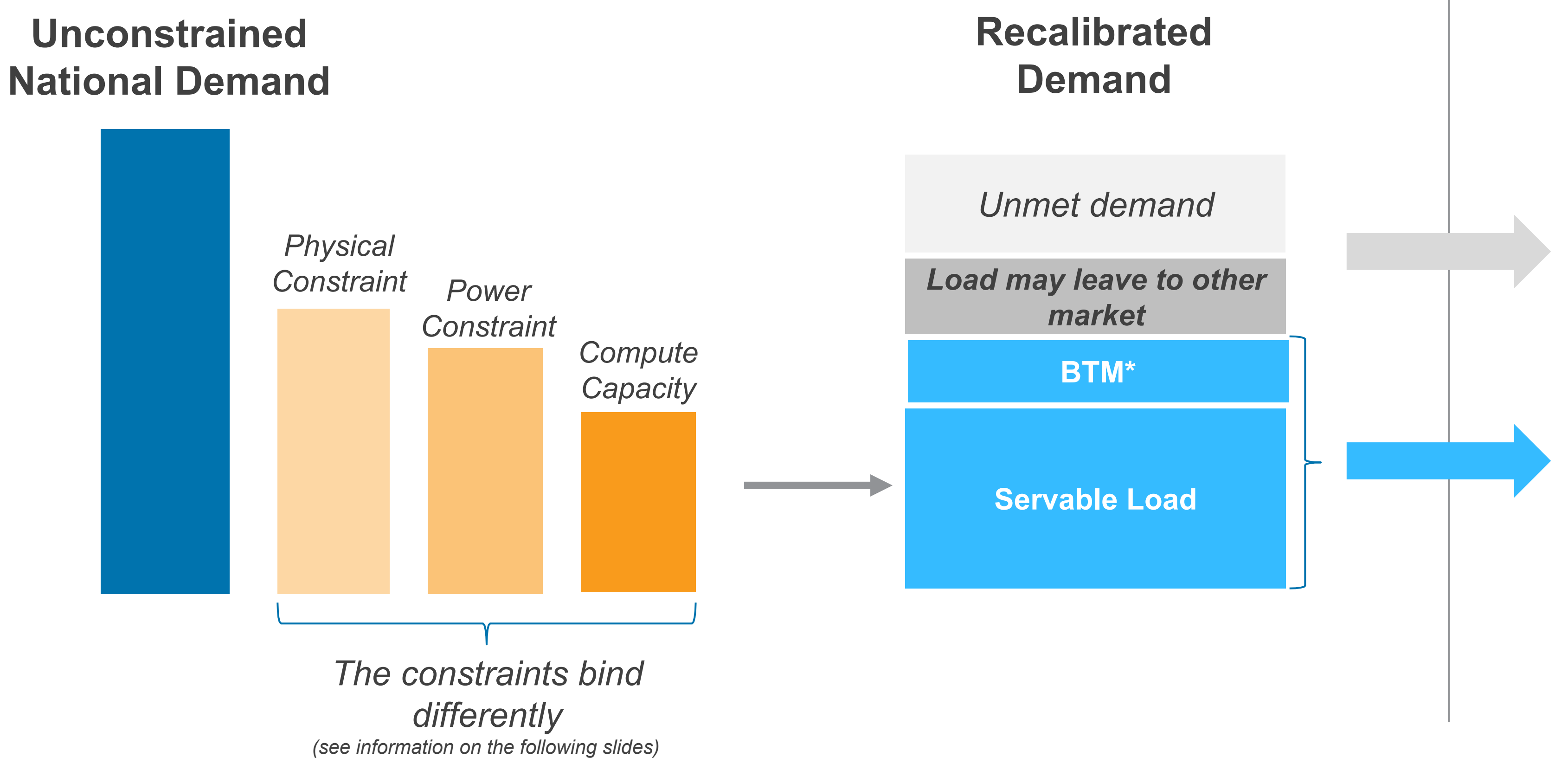
Recursive Top-Down Forecast Methodology

Convert unconstrained data center demand into PJM top-down load forecast by recursively identifying local allocation and binding constraints and estimating how investment relaxes them over time

Year *n*

Year *n+1…*



Unmet demand from prior year removed from starting demand in subsequent year, as loads may be delayed or fully leave the system (or go to a different market)

Recalibrated demand from prior year becomes starting baseline demand for subsequent year ("servable load"). BTM provides critical relief valve for power shortages in the near term

*Combination of fully-islanded and hybrid BTM

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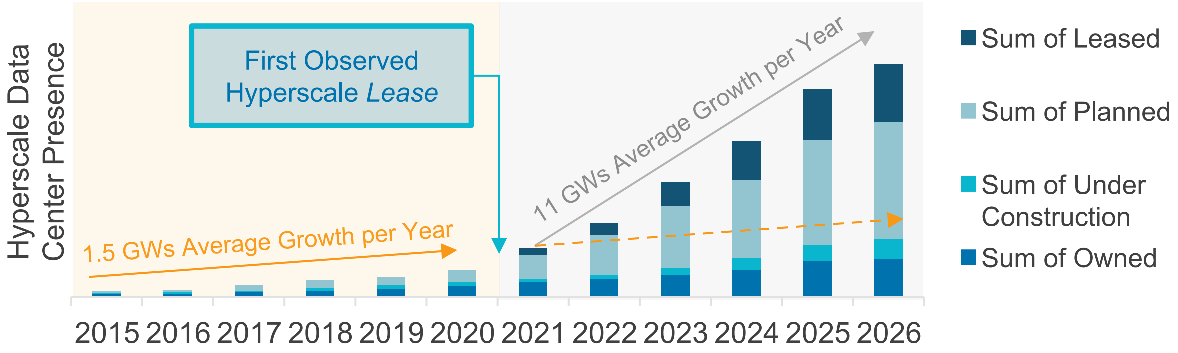
Projecting Unconstrained National Demand

Traditional Digital Economy

Use changing trends in data center growth to project out the traditional digital economy component of data center growth

Example of changing trends in observed hyperscale data center activity



Outcome: Traditional Digital Economy Projection
Estimate non-AI data center demand by projecting data center growth prior to significant shifts in data trends. Translate growth trends into GWs of data center capacity for non-AI applications.

Outcome: Projected Unconstrained National Demand and Eastern Share of Demand
Estimate total data center demand by projecting both non-AI and AI applications.

AI Demand

Construct AI Demand projections using current, observable trends in AI model development, hardware evolution, training versus inference split, and end-user characteristics.

Components of AI Demand Projections	Market Behavior	AI Software	AI Hardware
Training	• Quantity and type of models in development • New model development speed	• Training compute intensity	• AI/ML hardware efficiency *(speed and power)* • Data center PUE
Inference	• User adoption growth • User usage intensity	• Inference software efficiency	

Outcome: AI Demand Projection
Estimate AI data center demand by projecting currently observed trends in AI model growth, AI usage adoption, and hardware development. Translate key variables into GWs of data center capacity for AI applications.

Sources: datacenterHawk, epoch.ai, Pew Research, a16z, OpenRouter, Uptime Institute, Joule (journal), arXiv, and other recent research papers as needed

Constraints: Key Inputs, methods, sources

Key Input	Method	Sources
Power Constraint	Assess how availability of electricity generation PJM-wide and within PJM zones can slow or curtail the growth of data centers.	• CRA analysis • Public market data
Physical Constraint ***Metals***	Compare projected data center growth against raw material availability, identify potentially binding supply chains, and assess how production expansions may relax constraints over time.	• CRU analysis • CRA analysis
Physical Constraint ***Chips***	Assess semiconductor and compute hardware supply chain bottlenecks, identify key growth constraints, and evaluate how manufacturing expansions and technology developments may ease these constraints.	• Omdia analysis • CRA analysis
Compute Capacity	Analyze improvements in machine-learning hardware performance, compute efficiency, and energy efficiency to determine how technological progress may support greater AI workloads.	• Public data • Omdia analysis • CRA analysis

Constraint Relaxation

Policy & Market Actions
Assess how generation additions, transmission expansion (in the context of zonal supply-demand dynamics), interconnection reforms, and BTM resources may alleviate power constraints over time.

Supply Chain Expansion
Evaluate how production expansions, investment trends, and supply chain diversification may ease material constraints.

Technology Advancement
Assess how manufacturing capacity additions and technology advancements may reduce semiconductor constraints.

Performance Advancement
Evaluate how improvements in hardware performance and compute efficiency may enable greater AI workloads.

Key Assumption: supply-demand balance

Estimate the feasible generation available to serve the new load across PJM and peer ISOs through 2047

2026: Current Generation Mix

Establish the existing supply stack by PJM zone and technology type

- Inclusive of projects that have executed interconnection agreements through Transition Cycle (TC) 1, net of planned retirements per PJM deactivation notices.
- No probability adjustments are applied.

Sources: Energy Velocity, PJM IMM report, PJM deactivation queue

2027-2032: Queue-Informed Additions

Grow the supply mix using resources in PJM's active interconnection queue (TC1, TC2, Cycle 1)

- Apply observed historical and decision point attrition rates to account for project dropout
- Additions are further constrained by supply chain deliverability (turbines, transformers, EPCs) and zonal supply-demand dynamics (CETL/CETO + local generation by zone)

Sources: PJM queue data, PJM RPM planning parameters, PJM RTEP

2033-2047: Capacity Expansion Modeling

Shift to CRA's Long-Term Capacity Expansion (LTCE) modeling to project the generation mix beyond queue visibility

- LTCE outputs are subject to the same supply chain, transmission, and buildout constraints applied in the near term, and are allocated to zones based on projected demand gaps, transmission capacity, and resource suitability.

Comparable Market Assessment
(SPP, MISO, ERCOT, SERC)

Parallel supply-demand assessment across comparable markets to evaluate:

- *Generation availability and queue size*
- *Transmission capacity and development timelines*
- *Viability as alternative destinations for large-load customers*

Contextualizes PJM's competitive position relative to other regions where data center load could feasibly relocate.

System Reliability Assumptions

Reliability Assumption
Reliability standards will be maintained through policy, market, or operational interventions

Near-Term Flexibility
BTM resources (RICE, fuel cells, CTs, CCs, storage, DR) bridge the gap

Long-term Evolution
Workloads shifting across facilities and regions are expected to increase over time, improving system flexibility

- CRA assumes that policy, market, or operational actions will return the market to the traditional "**1-in-10**" reliability standard in the longer term. Potential mechanisms to ensure long-term reliability outlooks include state policy interventions, or data center commitments to provide flexibility. Current projected shortfalls provide an upper bound for the tolerance for capacity shortfalls.
- As a result, future data center growth will require increasing levels of load flexibility and/or delayed ramp rates as a result of PJM-wide and zonal supply-demand tightening. While data centers may gain greater ability to shift computing workloads over time, **BTM resources will play a critical near- and medium-term role.**
- Potential BTM resources include **RICE units, fuel cells, combustion turbines, combined-cycle units, batteries, and demand response** from other customers.
- Like front-of-meter resources, BTM resources face limits on **deployment at the site, zonal, and national levels**. However, BTM resources may be deployed more rapidly because they can often avoid traditional generator interconnection processes.
- The ability to **dynamically shift computing demand across sites and regions** is expected to increase over time as the workload shifting technology becomes more mature, enhancing overall system flexibility.

Power Constraint: Decision Tree

For zones with insufficient generation, excess load is addressed based on the following priority…

1. ZONAL SUPPLY-DEMAND BALANCE
Shortfall = demand – available grid supply – DC back-up – Policy Considerations*

no shortfall → All grid-connected

Grid held at 1-in-10 LOLE – regulators take action to ensure no increased reliability risks in grid.

if shortfall

2. RESOLVE IN PRIORITY ORDER

Each step, excess load peels off MW; any remaining load flows to the next

1. **ISLAND** –Full-island projects leave PJM (turbine-limited, determined by availability analysis); subtracted from supply & demand.
2. **RELOCATE** – If still short, the lowest-evaluated zones move to the next-best zone — PJM first, else exit PJM (see next slide).
3. **HYBRID** – If still short, data centers adopt hybrid BTM resources to meet least-cost resource mix of battery / RICE / fuel cell / DR to meet 99.999% reliability requirements, subject to site and zonal build limits for technologies.
4. **WAIT** – remaining, unmet demand likely waits. Unmet demand drives improvements in model efficiency.

3. TWO FORCES DECIDE THE OUTCOME

	Established market	Emerging market
Short Power	Behind-the-meter	Relocate / leave
Has Power	Wait / Stay on grid	Wait / Stay on grid

4. RECONNECTION: CRA assumes that all BTM is temporary — units run to end-of-life (~15 yrs), then seek avenues to reconnect to grid load.

*Considerations of evolving policy conditions such as Reliability Backstop, etc. These will be captured as policy evolves.

Relocating Load Across Zones and ISOs

If a zone's supply-demand binds, move the marginal megawatt to the next-best zone by evaluation matrix – within PJM first, then out to other regions of Eastern Interconnect + ERCOT

Geographic Scope Filter

- Restrict a fixed portion of national DC demand to the in-scope eastern share (Eastern Interconnect + ERCOT) – this sizes the pie before any zone allocation
- West (Phoenix, Reno, N. California, Texas) is out of scope; assumes load isn't fungible across East/West divide
- A calibrated east/west ratio anchored to observed data

Identify Preferred Zone

- Rank PJM zones to find where a displaced MW wants to go — the most attractive zone with room
- Attractiveness is based on the Bottom-Up evaluation (covered in Slide 26)
- Critically, the evaluation is dynamic— a zone's stickiness climbs as it builds out data center footprint, pulling more load (the "gravity" effect), but power availability declines

Test for Available Generation

- The gate: can an attractive zone actually take the load, or is it already short?
- Judged on the local supply-demand tightness, not just the PJM-wide dynamics. This allows load to spread across PJM as local regions tighten, but pushes load out of PJM when the entire region has insufficient supply to reliably serve all demand.

Yes headroom

STAY IN PJM

Move the MW to the next-best PJM zone — PJM Zone 1 → PJM Zone 2 → PJM Zone 3 → … Island resources can land anywhere (prestige projects).

No headroom

EXIT PJM → NEXT EASTERN ISO

Route via a generic, lighter-weight evaluation. Track supply-demand dynamics in MISO North/Central, MISO South, SPP, and ERCOT.

Note – Assumed that load shifts within PJM first because data centers are already anchored there (clients, contractors, suppliers, fiber). Outside PJM, we track where load grows broadly across non-PJM regions. Demand that no region can serve waits and feeds the compute learning factor (separate slide).

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Bottom-Up Forecast: Siting and Developer Evaluation Criteria

Zonal Siting Criteria **High Priority** *These factors are high priorities as developers seek to obtain the primary objective of "speed to market".*	**Power Availability**	Current and planned supply/demand and delivery picture, as well as electricity rates and tariffs. Zonal supply-demand dynamics and resulting reliability risks
	State / Local Regulatory Support	State, county and municipal attitude toward data center development and associated infrastructure
	Legacy Market Presence	Legacy market presence to achieve economies of scale/scope; alignment with customer demand
	Site Development Cost & Feasibility	Land/construction cost, energy costs, permitting / site-prep complexity, and incentives that offset build cost
	Resilience / Physical Risk Profile	Environmental considerations, disaster risk (i.e., winter weather, tornadoes, etc.)
Zonal Siting Criteria **Nice to Have** *These factors are mostly seen as pluses rather than requirements.*	**Fiber Connectivity**	Proximity or access to long-haul fiber-optic cables; distance to large metros/end-users
	Water	Access to nearby water for cooling
	Low Carbon Power Access	Access to or pathway to decarbonization
Project / Developer Readiness Criteria *Evaluates whether the project is sufficiently credible and mature to be included in the forecast, and how it should be weighted.*	**Developer Creditworthiness**	Development track record and credit quality
	Project Stage	How far the project has advanced (LOI vs. signed ESA, etc.), physical investment stage
	Type of Load	Robustness and quality of load (i.e., training vs. inference data center vs. crypto if available)

Applied to **each PJM zone (and other markets)** to assess the relative favorability for pipeline projects **(Bottom-Up)**, while identifying the regions most likely to attract incremental data center demand **(Reconciliation)**

Applied at the **project level** to evaluate project favorability at an aggregate level (i.e., not choose **specific winners or losers**)

Bottom-Up Forecast: Siting and Developer Evaluation Criteria *(continued)*

Zonal Siting Criteria
High Priority
These factors are high priorities as developers seek to obtain the primary objective of "speed to market."

- Power Availability
- State / Local Regulatory Support
- Legacy Market Presence
- Site Development Cost & Feasibility
- Resilience / Physical Risk Profile

Zonal Siting Criteria
Nice to Have
These factors are mostly seen as pluses rather than requirements.

- Fiber Connectivity
- Water
- Low Carbon Power Access

Evaluation Criteria
Illustrative

For each PJM Zone rank Relative Favorability
1 = Low
2 = Average/Medium
3 = High

X

Assign Category Importance Multiplier
Higher weighting for "High Priority" vs. "Nice to Have"; Scale of 1-20

= Zonal Evaluation Criteria

Same evaluation to be applied to the Top-Down forecast; to be reconciled as the Top-Down forecast will become more important than the Bottom-Up forecast in the longer-term outlook.

Project / Developer Readiness Criteria
Evaluates whether the project is sufficiently credible and mature to be included in the forecast, and how it should be weighted.

- Developer Creditworthiness
- Project Stage
- Type of Load

For each Pipeline Project rank Relative Performance
1 = Low
2 = Average/Medium
3 = High

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Bottom-Up Forecast: Siting Evaluation Criteria

Applied to assess the relative favorability for the pipeline of projects, while identifying the regions most likely to attract incremental data center demand

Category	Observable Evidence *Sample*	1 = Lower Favorability	2 = Medium Favorability	3 = High Favorability	X	Category Importance Multiplier 1 = Lowest, 5 = Highest
Power Availability	**Available capacity, interconnection activity, known system constraints**	Limited capacity and/or high-cost power.	Some capacity or upgrade path, but cost/timing is uncertain.	Clear path to serve load at competitive cost.		**5**
State / Local Regulatory Support	**Zoning, permitting path, recent approvals, public opposition, moratoria (pending or passed)**	Restrictive or uncertain approval environment.	Permitting path exists but with some risk.	Supportive policy and clear approval path.		**4**
Legacy Market Presence (dynamic)	**Existing data center footprint, hyperscaler/cloud presence**	Limited existing presence or customer activity.	Emerging presence, but pipeline depth or customer momentum remains uncertain.	Established market with proven delivery track record and active customer demand.		**3**
Site Development Cost & Feasibility	**Available tax credits, abatements, land costs, site-readiness programs**	Limited or uncertain incentives, excess vacancies in colocation availability.	Some incentives available, but not clearly differentiating, average vacancies.	Strong incentives that improve site competitiveness, low vacancies.		**2**
Resilience / Physical Risk Profile	**Flood, wildfire, storm, outage, and other site risk indicators**	High physical risk exposure.	Manageable risk with mitigation.	Low risk and strong resilience profile.		**2**

$\underbrace{\text{1 = Lower Favorability} \quad \text{2 = Medium Favorability} \quad \text{3 = High Favorability}}_{}$

CRA Independent Assessment of Project Siting Realization Probabilities

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Bottom-Up Forecast: Siting Evaluation Criteria *(continued)*

Applied to assess the relative favorability for pipeline projects, while identifying the regions most likely to attract incremental data center demand

Category	Observable Evidence *Sample*	1 = Lower Favorability	2 = Medium Favorability	3 = High Favorability X	Category Importance Multiplier 1 = Lowest, 5 = Highest
Fiber Connectivity	**Proximity to fiber routes via fiber maps**	Limited connectivity or redundancy.	Connectivity available but may require buildout.	Strong fiber access, redundancy, and latency profile.	2
Water / Labor	**Water availability, cooling requirements, labor availability, and contractor depth.**	Material water or labor constraint.	Available but with some cost or planning risk.	Adequate water and labor to support growth.	1
Low Carbon Power	**PPA options, renewable/nuclear/hydro access, and clean energy attributes.**	Limited clean power options.	Some options, but cost or deliverability is uncertain.	Clear pathway to low-carbon power.	1

CRA Independent Assessment of Project Siting Realization Probabilities

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Bottom-Up Forecast: Project / Developer Readiness Evaluation Criteria

Applied at the project level to evaluate relative favorability of the existing pipeline based on the strength of the project pipeline, developer track record, and evidence of execution progress

Category	Observable Evidence *Sample*	1 = Lower Favorability	2 = Medium Favorability	3 = High Favorability
Developer Creditworthiness	• **Sponsor/customer financial strength, track record, financing status, tenant commitments, and ability to provide utility credit support.**	Unknown sponsor or tenant; limited track record, financing evidence, or credit support.	Known developer or customer with relevant experience, partial financing or tenant interest, but limited evidence of balance sheet strength or firm commitments.	Established developer, hyperscaler, utility-scale customer, or well-capitalized sponsor with strong financial capacity, relevant track record, and credit support.
Project Stage	• **Development maturity based on existing substation access and site readiness, local fiber connectivity, and supporting infrastructure availability. Maturity of utility contracting, if available.**	Early inquiry or speculative site search; limited supporting evidence.	Some progress, such as identified site, land option/control, interconnection request, preliminary permitting, or active utility discussions.	Advanced project with executed service agreement, firm interconnection path, materially advanced permits, construction underway, customer commitment, or clear energization schedule.
Type of Load	• **Whether the proposed load is stable and durable or exposed to volatility, relocation risk, or uncertain utilization.**	Higher-risk or speculative load with uncertain long-term demand, volatile utilization, or limited customer stickiness.	Moderately durable load, such as colocation, mixed-use data center, or smaller enterprise load, with credible demand but uncertain long-term persistence.	Durable, high-confidence load, such as hyperscale, AI cloud, or strategic enterprise load with strong demand drivers, clear customer need, and high likelihood of sustained utilization.

CRA Assessment of Project / Developer Readiness

Example: Fiber Connectivity

Assess PJM Zones based on fiber hub presence, potential for redundancy, and the coverage of fiber in the zone

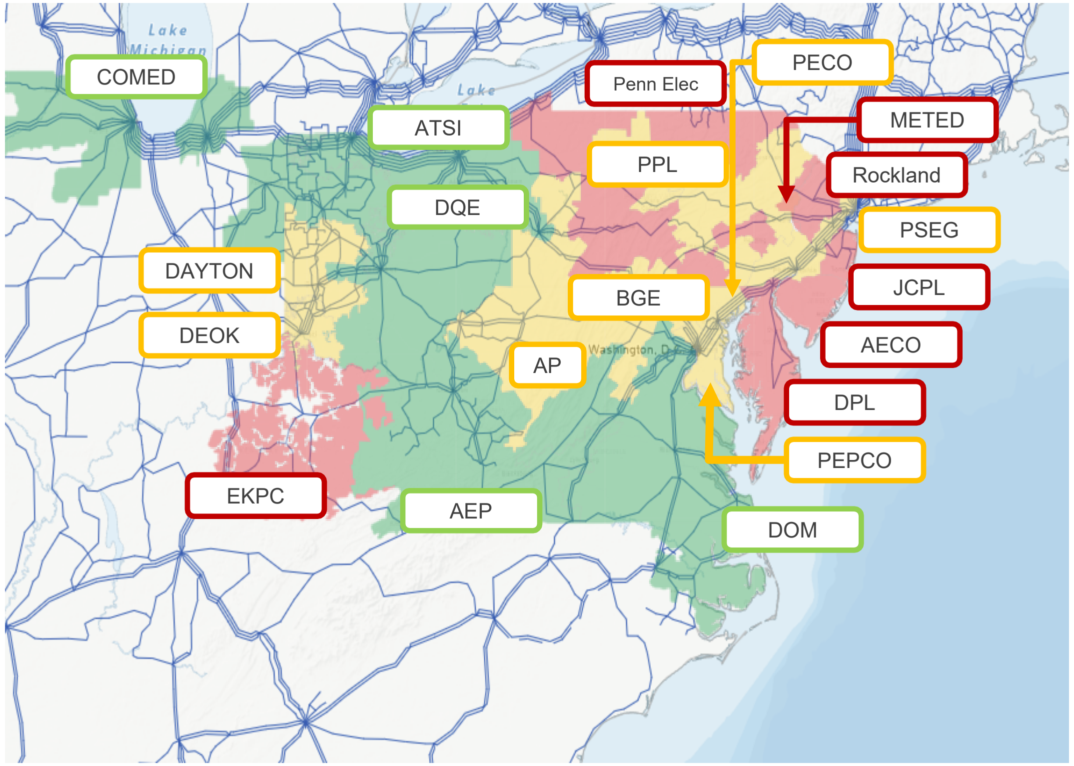
Zones	Relative Connectivity Measure
COMED	Higher
ATSI	Higher
AEP	Higher
DOM	Higher
DQE	Higher
DAYTON	Moderate
PECO	Moderate
BGE	Moderate
PEPCO	Moderate
PSEG	Moderate
DEOK	Moderate
APS	Moderate
PPL	Moderate
EKPC	Lower
Penn Elec	Lower
DPL	Lower
JCPL	Lower
Rockland	Lower
METED	Lower
AECO	Lower

Higher Connectivity Zones
Zones with at least one fiber hub (where many lines congregate to a point), strong redundancy potential (multiple lines in the same long-haul path) and strong fiber coverage across the zone.

Moderate Connectivity Zones
Zones that may not have a hub, but still have some redundancy potential and/or adequate fiber coverage relative to other zones.

Lower Connectivity Zones
These zones typically do not have a fiber hub, have limited redundancy potential, and do not have as strong of fiber coverage relative to other zones.

Long-Haul Network Map with PJM Zonal Overlay



Sources: ITU Fiber Optic Maps

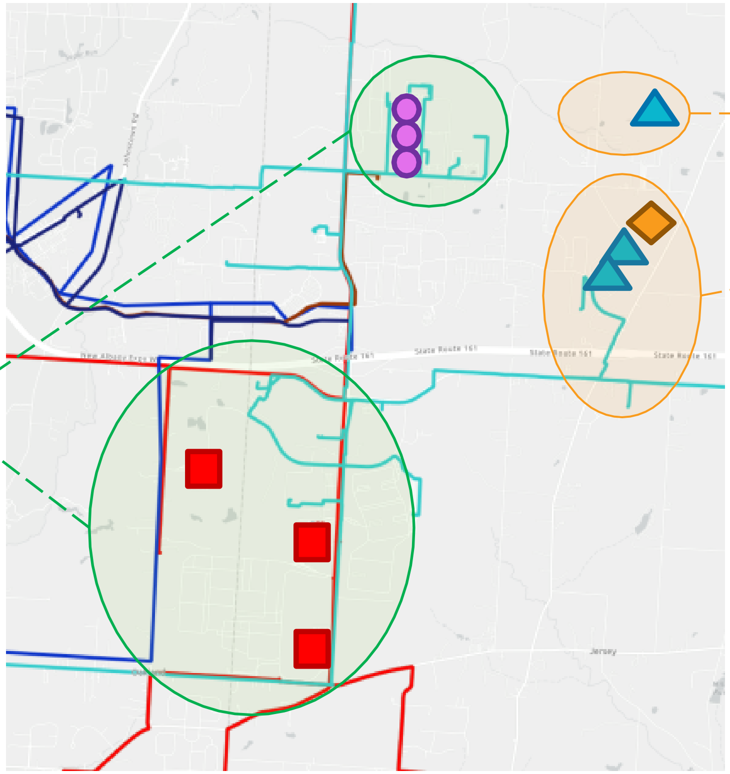
Disclaimer: this is a high-level and relative view evaluated between PJM Zones; this view does not directly comment on the general internet availability of each zone. OVEC is not visually shown due to relatively small geographic footprint

Example: Fiber Connectivity (Cont.)

CRA's data provider datacenterHawk enables highly localized fiber optic cable analysis, allowing for granular, site-level analysis

Example Fiber Network Overlay with Data Centers near Columbus, OH

Several commissioned data centers from developers "A" and "B" have fiber access to their commissioned campuses.



Another planned data center from developer "C" may not yet have direct fiber access but may have extension opportunities from existing lines.

Commissioned "C" and "D" data centers have a fiber extension off a main line.

Legend

- Data Center Developer A
- Data Center Developer B
- Data Center Developer C
- Data Center Developer D
- Fiber Optic Cable *(Colors represent different providers)*

Key Implications

✓ Parcel-level fiber and power availability analysis enables moving beyond market-level assumptions to identify fiber readiness on specific sites.

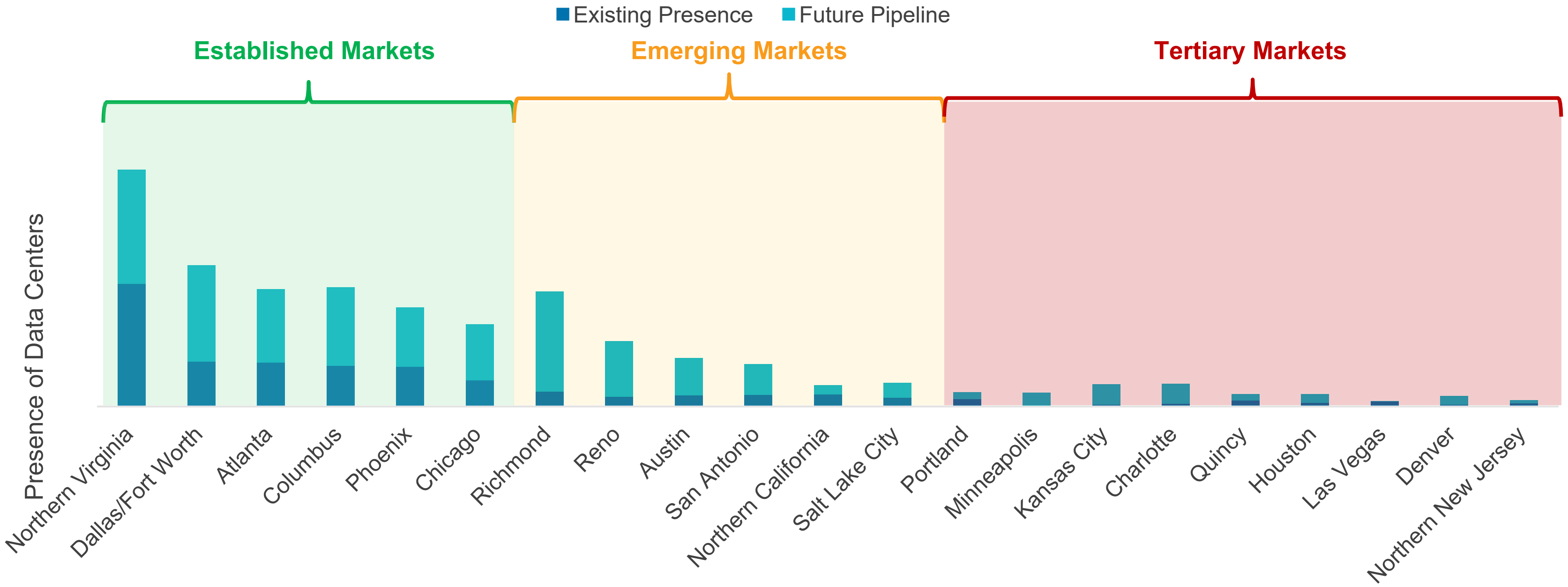
✓ Supports bottom-up analysis evaluation by providing granular transparency when evaluating fiber availability.

 Sources: datacenterHawk

Example: Established Markets

Analyze the total in-use data center MWs and future planned & under construction data centers in key markets to infer market maturity and economies of scale

Existing and Forecasted Market Size of Key US Data Center Markets (MWs)



Established Markets are regions with substantial data center build out and a large pipeline.

Corresponds to **High** favorability on *Established Market* evaluation

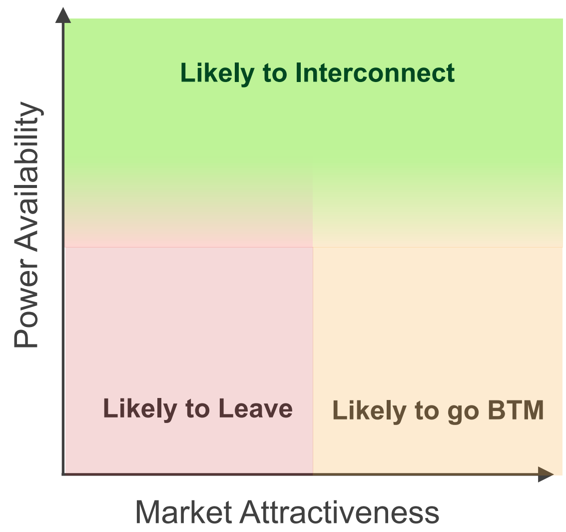
Emerging Markets are regions that have some data center capacity and are seeing strong growth in the pipeline.

Corresponds to **Medium** favorability on *Established Market* evaluation

Tertiary Markets are regions that have not yet had a proven track record of holding onto significant volume of data center customers.

Corresponds to **Low** favorability on *Established Market evaluation*

Illustrative Power Availability vs. Established Market Dynamics



Sources: datacenterHawk
Tail of Tertiary markets are omitted

Example: Established Markets vs. Emerging and Tertiary markets

Each market type shows different risks and benefits that must be factored when evaluating their pipeline

Established Markets

- Established utility, zonal, and data center ecosystems
- Proven ability to serve large-scale load growth
- Long-standing relationships with utilities, regulators, and local governments
- Mature workforce and supplier base
- Established fiber and cloud ecosystems
- Large concentration of cloud, carrier, and network infrastructure
- Access to large customer and population centers

Risk profile

- Lower project-level execution risk due to market depth and developer diversity
- Risk of congestion, rising costs, transmission constraints (in the context of zonal supply-demand dynamics), and policy pushback as markets mature

Emerging or Tertiary Market

- Potential for faster speed-to-power in select locations
- Aggressive tax, infrastructure, and regulatory incentives to attract data centers
- Lower congestion in permitting, zonal, and development pipelines
- Opportunity to leverage nearby established fiber ecosystems
  - Power availability may be a more binding constraint than fiber availability for many AI-oriented developments
- Lower land and development costs in some regions
- Construction labor and specialized contractor availability can become a bottleneck as markets scale

Risk profile

- Greater dependence on a smaller number of projects and developers
- Higher sensitivity to power-delivery and infrastructure execution timelines
- Some development reflects spillover from constrained established markets
- Successful projects can establish self-reinforcing growth clusters and attract additional investment

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Meeting Agenda

Topic	Timing
Introductions	9:15 – 9:25 AM
Data Collection, Validation, & Integration	9:25 – 9:40 AM
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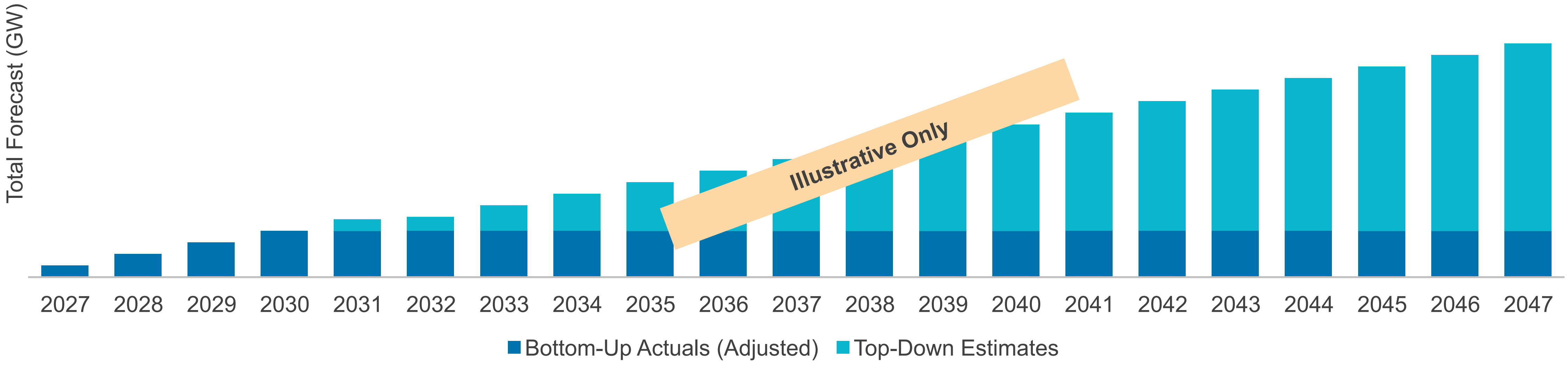
Q&A	10:55 – 11:55 AM
Next Steps & Close	11:55 – 12:00 PM

Bridging the Top-Down and Bottom-Up Forecasts over the Time Horizon

2027-2031 Constraints bind	2031-2047 Filling in Pipeline
Bottom-Up exceeds **Top-Down**. Constraints bind. Bottom-Up projects are delayed, relocate or go **BTM** based on relative evaluation.	However, given the Bottom-Up forecast only extends so far out, generic project assumptions may need to be made beyond that. Therefore, generic bottom-up project pipelines may need to be filled in with generic projects to meet**Top-Down** forecast if Top-Down forecasts exceed the total Bottom-up pipeline. Location of new generic projects will be determined using zonal evaluation criteria assessed in the**Bottom-Up** evaluation matrix. Note that the **Top-Down** may grow over time (deep AI adoption scenario) or may decline (efficiency gains scenario).



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Managing all types of uncertainty

Managing both uncertainty due to lack of knowledge and pure randomness

Uncertainty due to lack of knowledge	Uncertainty due to randomness	
Scenarios	**Sensitivities (Monte Carlo)** ***By Project***	**Sensitivities (Monte Carlo)** ***Hourly Random Outcome***
Different states of the world (i.e., depth of AI adoption and speed to onboard power).	Different outcomes based on randomness (i.e., if a project has a 10% probability of success, in 100 random outcomes or coin flips, it should succeed 10 times and "fail" 90).	• Hourly demand can vary hour to hour • Create stochastic models and intra-hour profile based on data center type and characteristic load profiles

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Impact of Scenarios

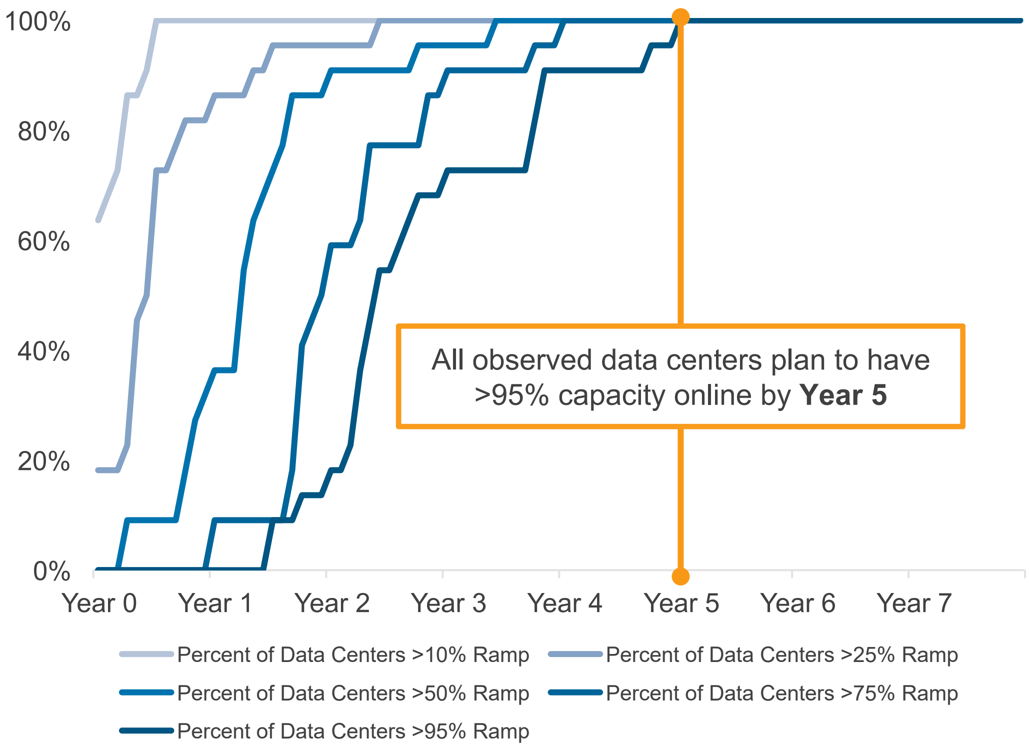
Using scenarios can illustrate how demand growth and constraints interact under different states of the world, how quickly constraints relax, and therefore how much national demand can realistically translate into regional load

State of the World	Constraint Environment	Impact on Top-Down Forecast
Base Case / Managed Growth	AI adoption continues, but power, supply chain, and siting constraints slow realization. Going forward, new infrastructure accelerates beyond current rates.	*Demand grows steadily, but constraints cap near-term load realization and push some growth into later years.*
Abundance Case	Infrastructure, compute, and power constraints are relaxed faster than expected; efficiency gains also improve.	*Higher AI adoption and faster load growth, with fewer binding constraints limiting demand realization.*
Power-Constrained Growth & Evolving Inter-region dynamics	AI demand remains strong, but power availability and interconnection remain severely constrained (current rates remain), particularly in legacy markets.	*National demand exists, but regional load realization is significantly limited by deliverability, cost, and timing of power. Data centers are likely to increasingly shift toward emerging and tertiary markets.*
Slower Adoption	AI adoption is more measured due to cost, use-case uncertainty, efficiency improvements, or customer adoption friction.	*Lower overall demand trajectory, with less pressure on infrastructure constraints and slower regional siting.*

Ramp Rates

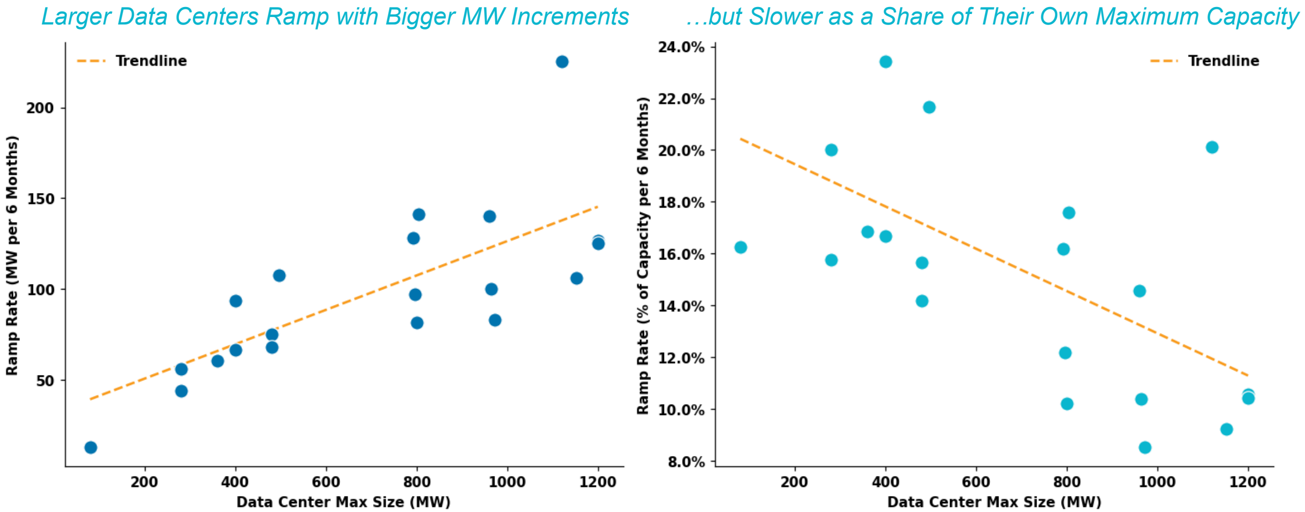
CRA will project ramp rates based on EDC/LSE submissions, historical development patterns if available, and supply-demand dynamics

Data Center Ramps from LSE Submission show General Trends



Note: Data has been aligned so that the first observation of each data center ramp is one month before the first MWs are ramped (ignored if the first monthly observation already has MWs energized)

Larger Data Centers Generally Ramp with Higher MWs, but are Proportionally Slower Relative to Smaller Projects



Note: calculated as the change in observed MW capacity between each month and the same data center's capacity 6 months earlier, averaged across the ramp period (which is between the first MWs coming online, and when the data center's MWs is equal to the maximum observed in the data)

Data center ramps are not necessarily uniform – CRA will consider factors such as size of data center when modeling data center ramp schedules

 Source: LSE submission

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Hourly Shapes and Load Factor

Empirical data on the operational load profiles and load factors of data centers remain limited, and potential evolution of load profile and load factors is uncertain. Further, hourly demand is inherently probabilistic. CRA proposes to utilize characteristic hourly shapes with stochastics to model hourly shapes of data centers.

Traditional Compute

- Traditional compute captures autocorrelated load profiles with hour-of-day and calendar effects

AI Training Compute

- Limited-to-no seasonality and limited-to-no autocorrelation between time steps, with relatively consistent high load factors
- Load profiles may vary significantly from hour-to-hour to capture bulk-synchronous training

AI Inference Compute

- Captures autocorrelated load profiles with hour-of-day and calendar effects
- As reasoning models and agentic models become more prevalent, *AI Inference load profiles are projected to be modeled to be less sensitive to hour-of-day and calendar effects*, making the load shape ‘flatter’

Identify Characteristic Shapes

To best capture ‘typical’ hourly behavior for different data center workloads (normalized to 0~1)

Incorporate Stochasticity

To best capture a range of potential events, rather than a single characteristic shape

Apply Forecasted Capacity

Scale normalized by expected data center growth by zone, distributed by estimated relative compute needs for training / inference

Note: CRA acknowledges that the exact evolution of hourly profiles is uncertain and is rapidly evolving. Exact shapes / values are subject to change as we further investigate, and factor in, compute cluster developments

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Next Steps

- LSE/EDC form submissions due – September 4
- Individual meetings with EDCs/LSEs in September/October
- Final results presentation October 14 LAS meeting

We thank you for your support and participation, both today and throughout this process!

For any additional questions or comments please reach out to Load_Analysis_Team@pjm.com.

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