ARTIFICIAL INTELLIGENCE: BALANCING POTENTIAL BENEFITS WITH FUTURE LOAD GROWTH EXPECTATIONS

INNOVATION WEBINAR

September 19, 2024

3:00 - 4:00 p.m. ET

NARUC CPI Innovation Webinar

Moderator
Hon. Erik Helland
Iowa Utilities Commission

Anuja Ratnayake
Emerging Technology Executive, EPRI

Hanna Grene
Microsoft, Global Energy & Resources GTM

Brian E. Hoff
VP of Product Management, GE Vernova

Briana Kobor
Head of Energy Market Innovation, Google Energy

About NARUC

- Founded in 1889, the National Association of Regulatory Utility Commissioners (NARUC) is a non-profit organization dedicated to representing the state public service commissions who regulate the utilities that provide essential services such as energy, telecommunications, power, water, and transportation.

- NARUC's members include all 50 states, the District of Columbia, Puerto Rico, and the Virgin Islands.

- Our mission is to serve the public interest by improving the quality and effectiveness of public utility regulation.

About CPI

- The NARUC Center for Partnerships & Innovation (CPI) builds relationships, develops resources, and delivers training to assist state commissions contending with complex current and emerging issues.
- CPI is funded by cooperative agreements with the U.S. Department of Energy (DOE) and the U.S. Department of Commerce's National Institute of Standards and Technology (NIST).
- NARUC CPI conducts work across five key energy areas and many topics within each: generation; transmission; distribution; customers; and critical infrastructure preparedness, response, and resilience.
- For more information, visit: https://www.naruc.org/cpi/cpi-home/

Upcoming Events

Virtual Events:

- **NCEP Aggregated Distributed Energy Resources in 2024: The Fundamentals Webinar –** Sept. 27
- **Workforce Development Webinar on interagency dialogue** – Sept. 30
- **Regulators' Roundtable Series: Wildfires and Affordability: Financial, Regulatory, and Policy Issues for Regulator Part Three of Three** – Oct. 8
- **NCEP Member updates Webinar** – Oct. 11
- **Innovation Webinar on Equity and Access in Grid Modernization -** Oct. 24

September & October In-Person Events:

- **Cybersecurity Training, Philadelphia**, PA, Sept. 24 – 25
- **Natural Gas Task Force Workshop,** Atlanta, GA, Oct. 18 – 19
- **NCEP Annual Meeting**, Phoenix, AZ, Oct. 29 – 30
- **NARUC Annual Meeting,** Anaheim, CA, Nov. 10 - 13

See our full list of events: https://www.naruc.org/cpi/cpi-events/

NEXT INNOVATION WEBINAR: EQUITY AND ACCESS IN GRID MODERNIZATION

- October 24th 3:00 PM ET – 4:00 PM ET
- As the energy landscape evolves, grid modernization has become a critical focus for utilities and regulators alike. This session will delve into the vital issue of ensuring access and equity in the transition towards a more modern, resilient, and sustainable grid. Grid modernization presents both opportunities and challenges, particularly in how benefits and costs are distributed among customers, including low-income households and disadvantaged communities. This panel will explore strategies to ensure that the grid serves all customers equitably.

Today's Speakers

Future of Demand and Generation

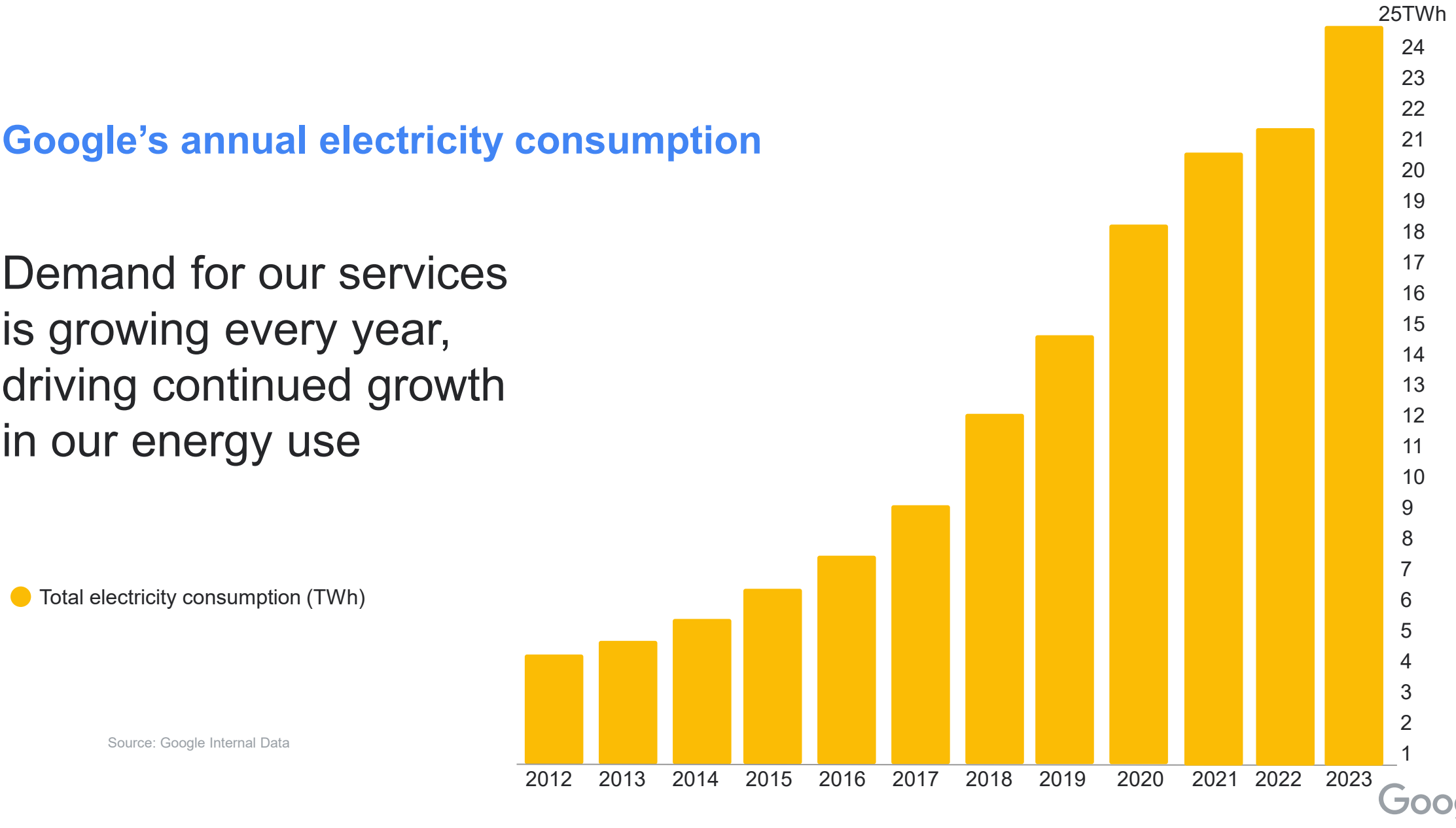
NARUC Webinar
September 19, 2024

Briana Kobor
Head of Energy Market Innovation, Google

Google Search I'm Feeling Lucky

Google's annual electricity consumption

Demand for our services is growing every year, driving continued growth in our energy use



Source: Google Internal Data

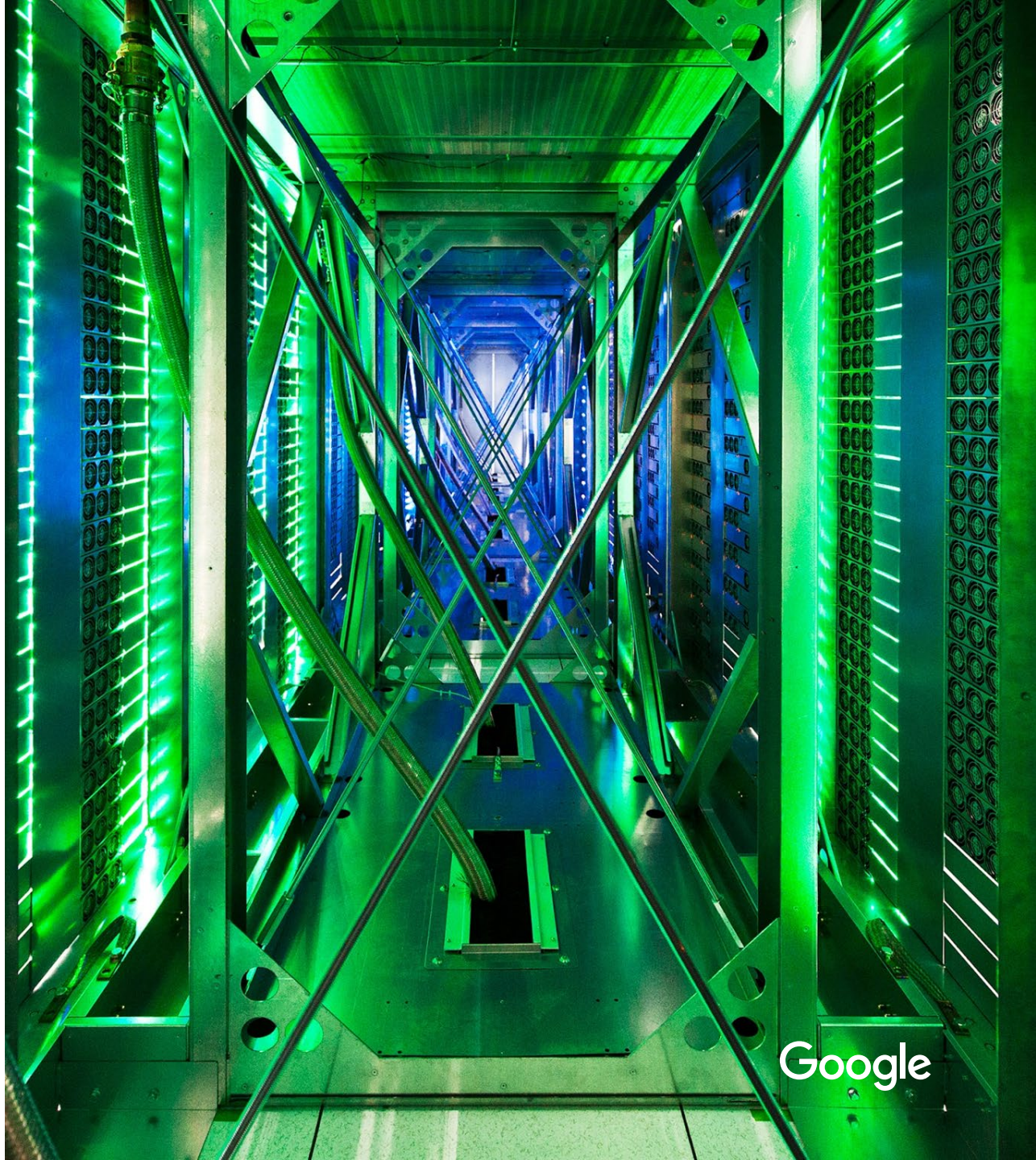
Google

New Models for Demand Growth

New infrastructure investments offer significant cost-saving opportunities—thanks to efficiencies from increased industrial load—they also involve substantial financial risks if demand does not materialize as expected.

Solutions to address this issue must:

- Maintain regulatory certainty and fairness by focusing on the challenges associated with all new large loads
- Structure customer commitments to align with the timelines and minimum payments needed to support cost recovery
- Require upfront collateral to ensure financial stability
- Support modification of customer commitments subject to fair and transparent fees



GE VERNOVA

ORCHESTRATING A MORE SUSTAINABLE ENERGY SYSTEM USING AI, DATA, AND SOFTWARE

Brian E. Hoff

Electrify this **Changing** world while **Decarbonizing** it

GE VERNOVA

Electrifying - eVs, Heat, Rooftop solar, Data Centers

VOLUME

- **Heat pumps:** 180 M ('20)-> 600M ('30)[2];
- **Electric Vehicles:** 16M ('21)-> 350M ('30)[2]

Changing - Weather, cyber events, regulations

VELOCITY

- Storm Damage est. (US) $1.7T (1980-2020); $600B (`17-`22)[3]
- Cyber Attacks (US) 1H (`22) vs 1H (`23) 40% more (94)

Decarbonizing - Renewable Wind and Solar

VARIABILITY

- **REN Gen.:** 29%/$0.8T ('21)-> 61%/$2.9T ('30)[1]
- **Utility scale storage:** 16GW ('21)->680GW ('30)[2]

1- Frost and Sullivan Report 2- IEA report 3- Climate Central 4- DOE Report

Electrify the world while **decarbonizing** it

GE VERNOVA

ORCHESTRATE
(probabilistic & variable supply/demand)

DECENTRALIZATION
(many and generator following)

HIGHLY ADAPTABLE
(flexible grid services)

Reliability

Affordability

Sustainability

Electrify the world while **decarbonizing** it

GE VERNOVA

Data + Artificial Intelligence

Enterprise Software

New set of capabilities enabled by data, AI and Software:

DETECTION	PREDICTION	OPTIMIZATION
e.g., Behavior of DERs, fault detection, cyber threat, visual detection	e.g., Supply and demand, system inertia, system strength, distribution state estimation	e.g., Market clearing, topology optimization

Data and AI to manage variability, volume and velocity

Improve wind and solar generation Forecast

Grid Balancing & Restoration with high Reliability/Resilience

Improve Demand Forecast

Increase grid utilization/capacity/quality

Efficient Demand Response and load shedding

Planning and Operations of Renewables, Energy Storage & DER Resources

Wildfire/Storm preparation, execution & restoration (PSPS), Virtual Operator

Model management

Examples:

Detection

- **Discoveries** - DERs
- **Anomalies** – Oscillation source detection, localization; Visual detection

Prediction

- Forecast: Supply, Load, outages, System Inertia & Strength
- Virtual Operator, state estimation

Optimization

- Market clearing, topology optimization

AI Solutions

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Visual Intelligence - Lidar & Satellite

AI-based visual intelligence (VI) for vegetation management, asset inspection, and enhanced network model accuracy

AI-based VI results – Lidar & Satellite

- Up to **20%** vegetation O&M reduction
- Up to **30%** fewer tree caused outages

AI-based load & DER forecasting

AI-enabled behind the Meter forecast (non measured) for millions of nodes

AI-based load & DER forecasting pilot results :

- 200 second duration for configuring 100K nodes (vs. hrs.-weeks)
- Forecasting from 2 weeks ahead to 2 months ahead (within confidence constraints)

Disruption Prepare - Wildfire & Storms

AI-based disruption preparation, damage prediction and estimated resources for grid resiliency

Disruption Prepare outcomes:

- **Wildfire Risks –** Across utility service territory with township level of detail
- **Utility Asset Risk –** Asset level risks
- **Explainable AI –** Detailed explanation of risks per region

DISRUPTION PREPARE - WILDFIRE GENAI

GE VERNOVA

Distribution

ADMS

HAZARD MANAGEMENT

Transmission

REAL TIME SHUTDOWN

RESTORATION MANAGER

EMS

Inputs

- Asset Topology
- Satellites HS
- Weather Forecast
- Public Wildfire Datasets

DISRUPTION PREPARE (DP)

GRIDOS CONNECT

GRID DATA FABRIC

Microsoft

MICROSOFT AZURE

Outputs

- Risk Assessment
- Damage Prediction
- ADMS Hazards


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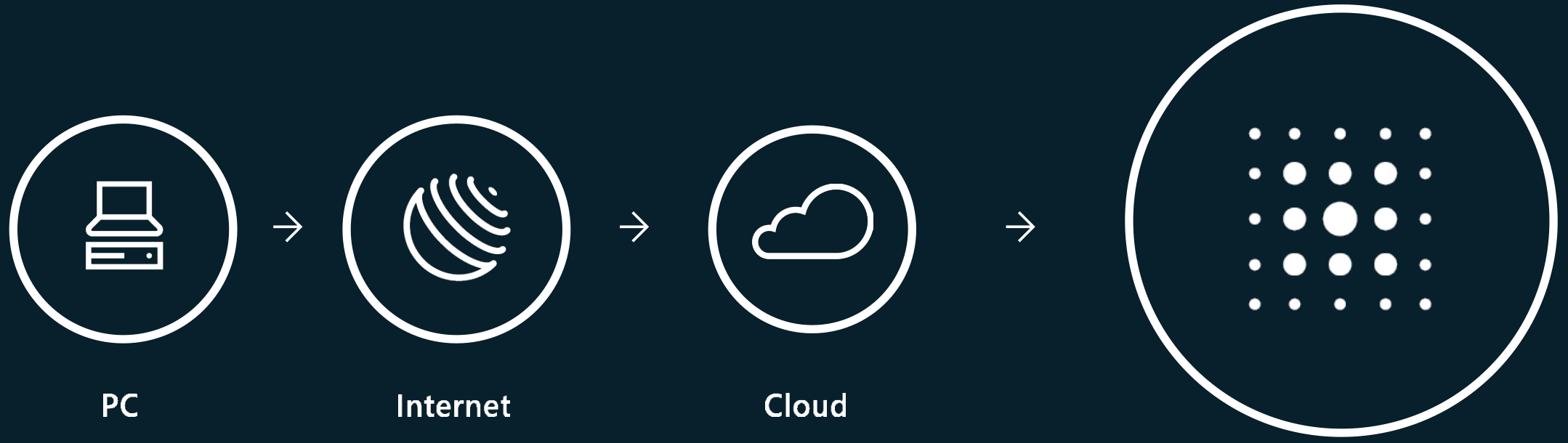
The journey to the future

Generative AI is the largest platform shift since the advent of the Internet



PC

1970s 1980s

Internet

1990s

Cloud

2000s

Generative AI

2020s

The journey to the future

The tech that got us here won't get us there

Database-driven

Connect your data

Coding expertise required

Converse with data

All the data, few insights

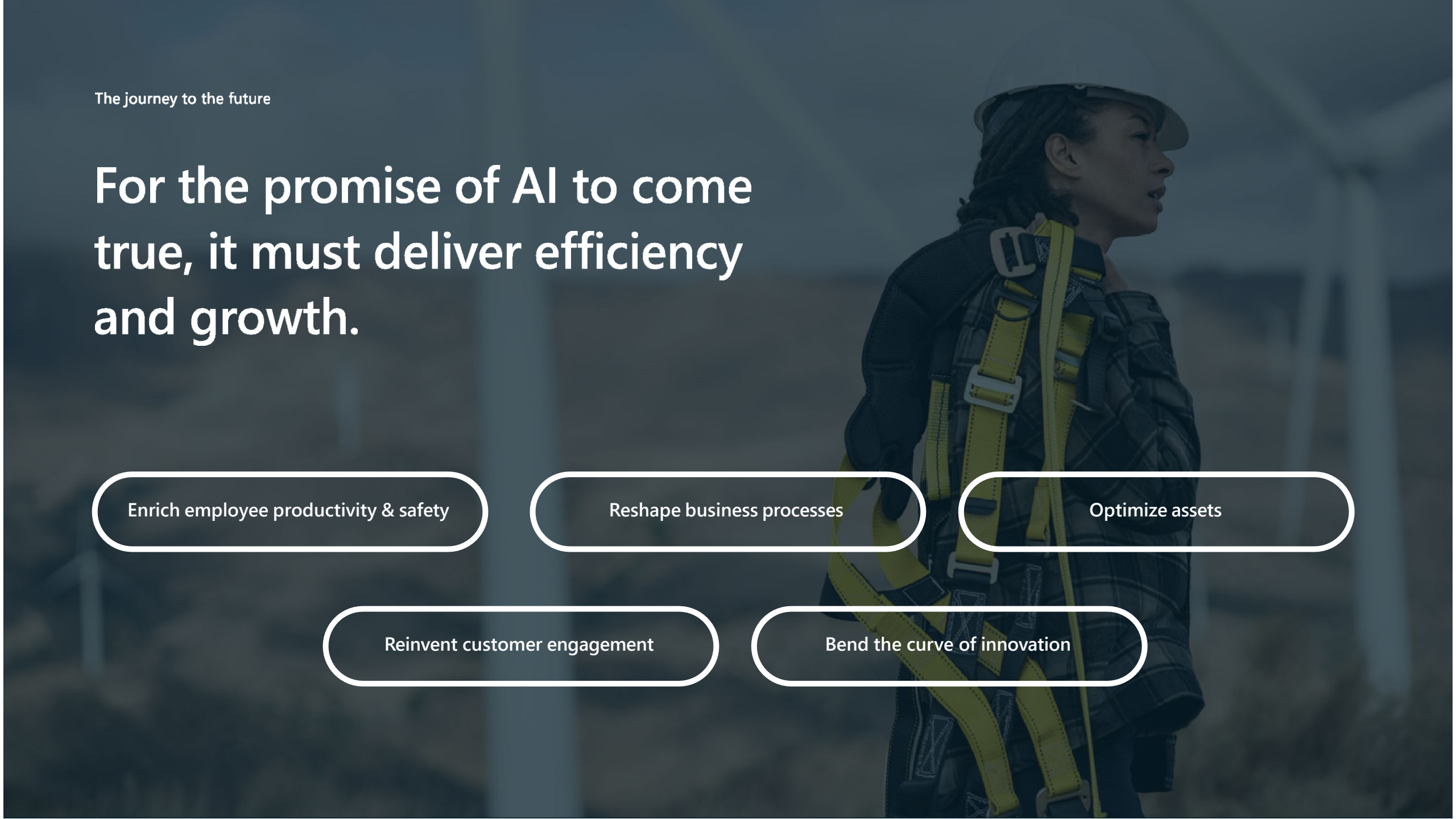
Improve insights with AI learning

For every $1 a company invests in AI, it is realizing an average of $3.50 in return

IDC Business Value of AI Survey, September 2023

The journey to the future

For the promise of AI to come true, it must deliver efficiency and growth.



Enrich employee productivity & safety

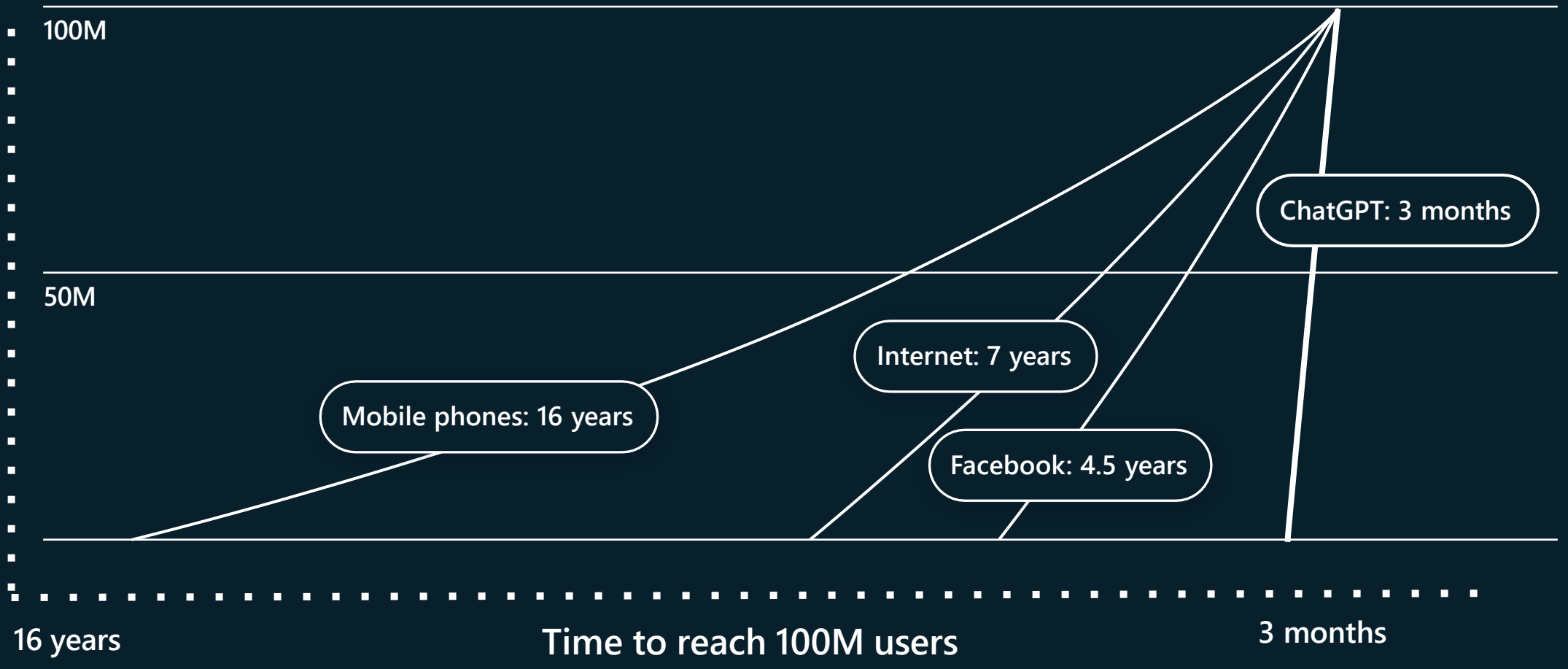
Reshape business processes

Optimize assets

Reinvent customer engagement

Bend the curve of innovation

Generative AI technology is here



Keys to driving impact with AI

The proven formula for driving results with AI

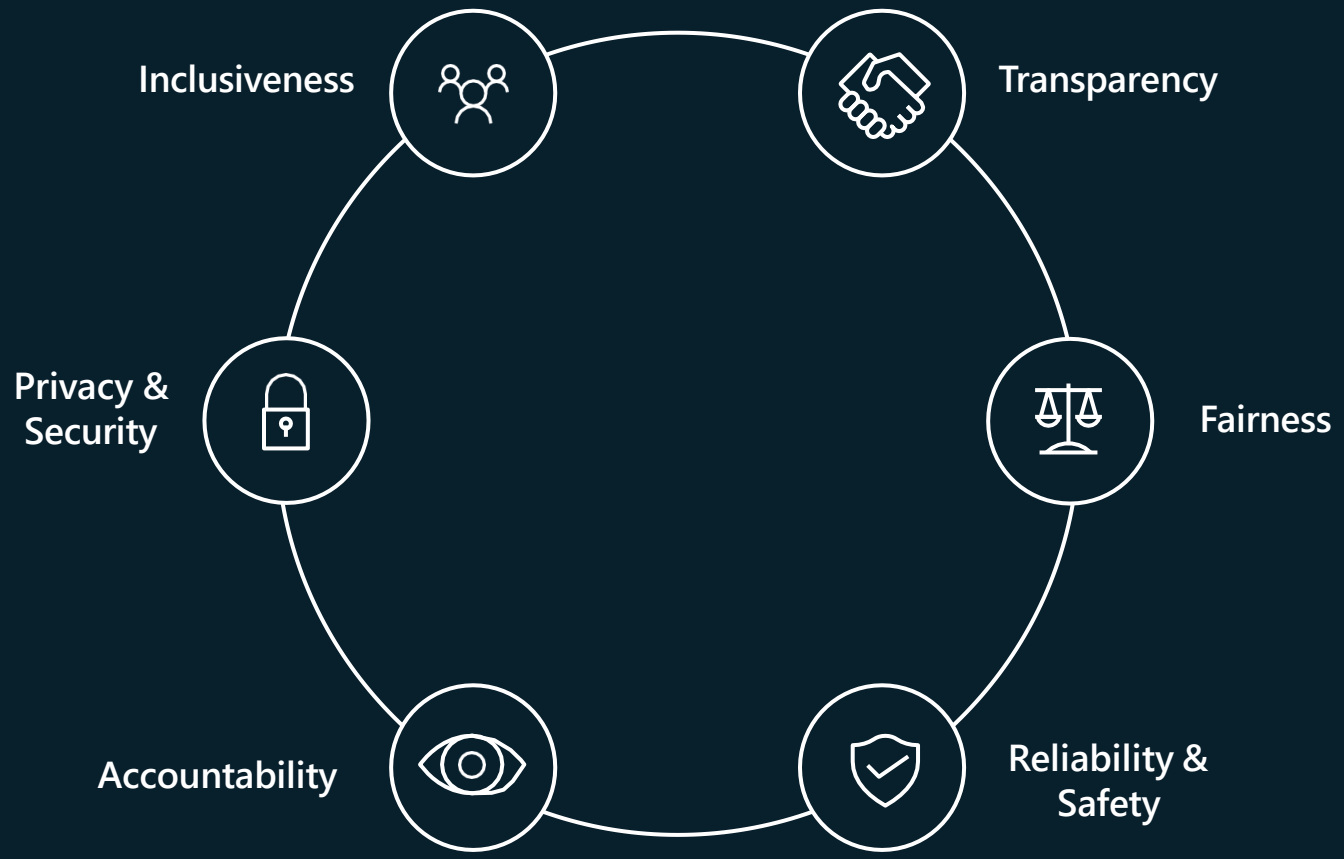
Fuel AI  with data in the cloud

Prioritize  to drive impact

Empower  and train your people

Keys to driving impact with AI

Microsoft's responsible AI principles



Data Centers

Challenges and Opportunities

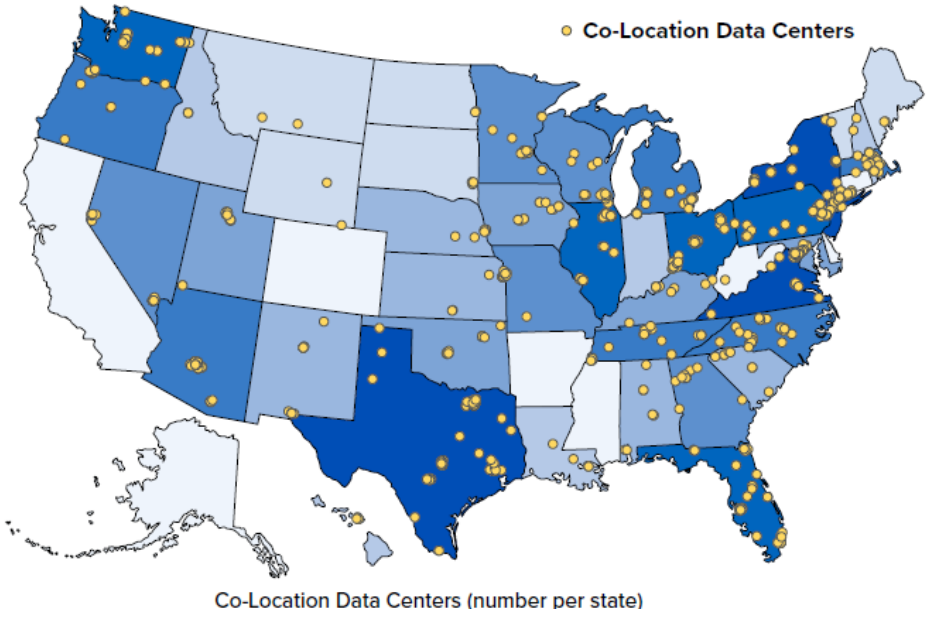
AI: Balancing potential benefits with future load growth expectations

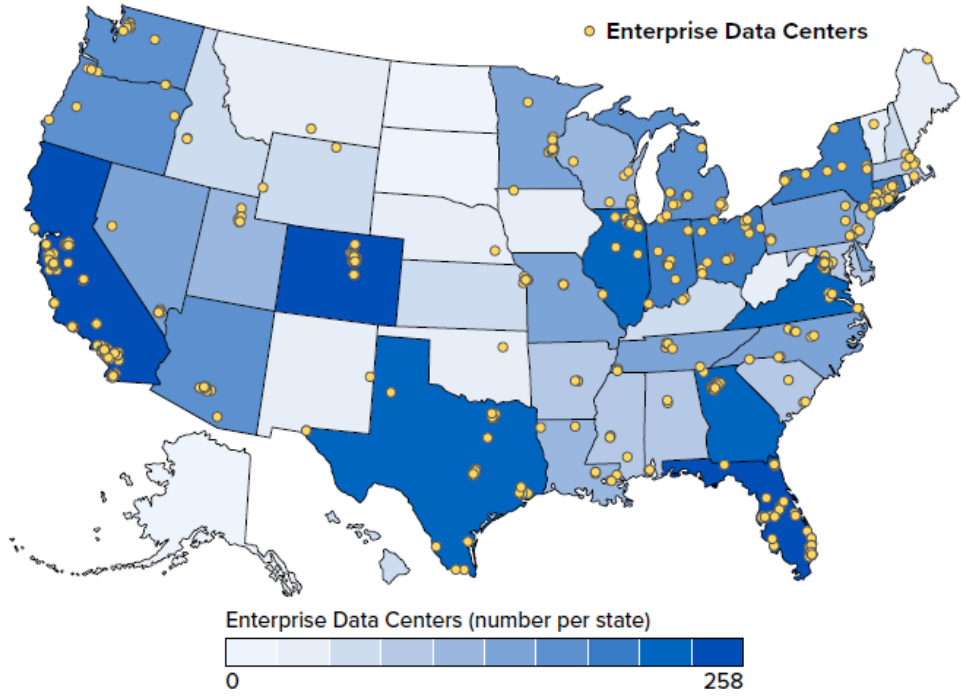
Anuja Ratnayake, EPRI
September 19, 2024

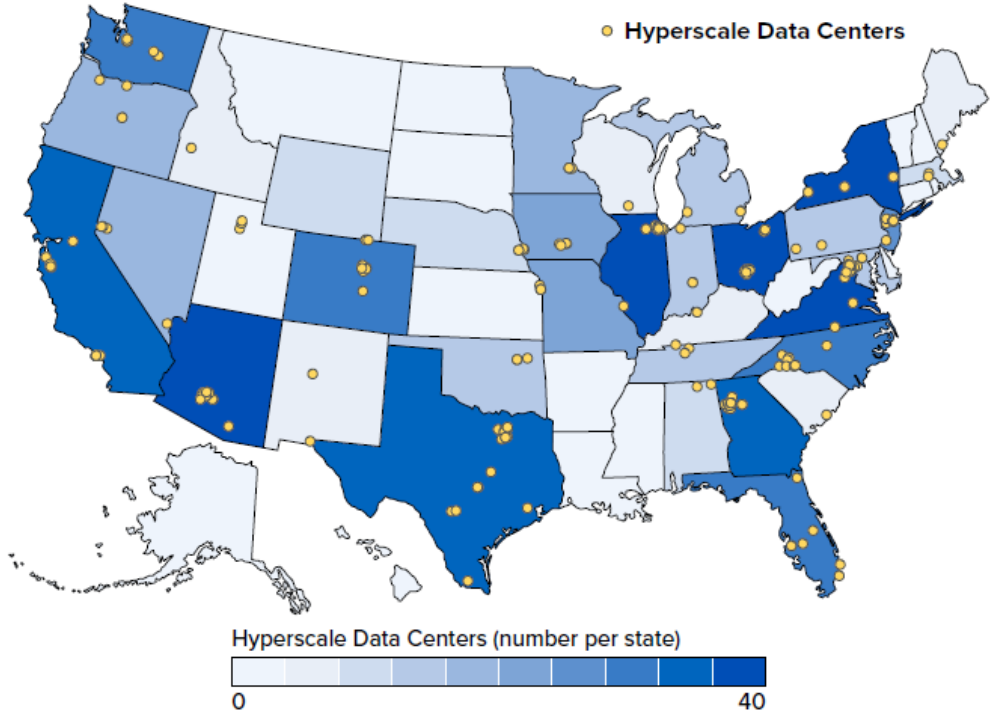
Data centers in the US

- As of March 2024, there were approximately 10,655 data centers globally; half of them, 5,381, were in the United States.

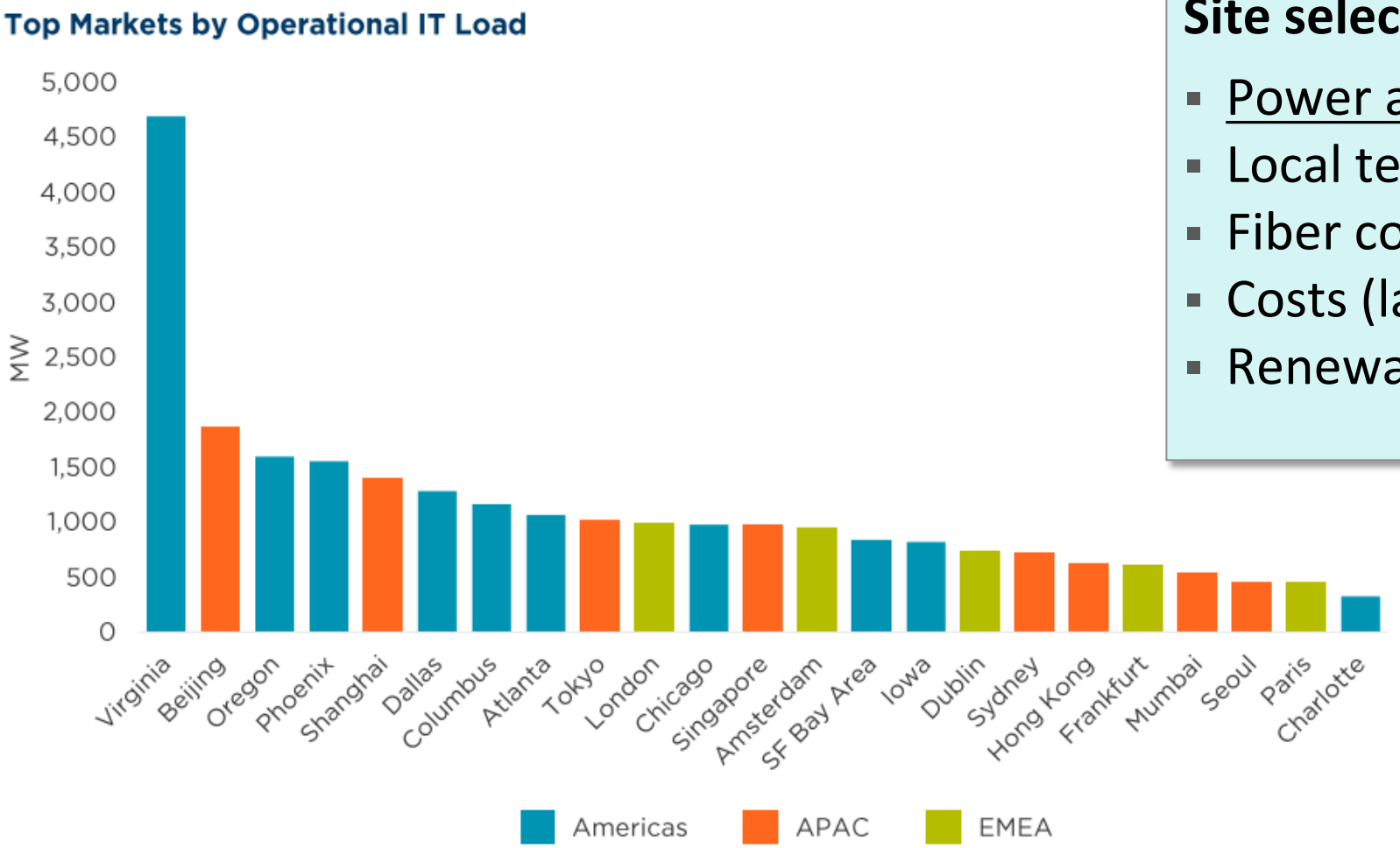
Source: EPRI Technology Innovation, *Powering Intelligence*, May 2024







Data Centers Today are Concentrated Regionally … But are Spreading



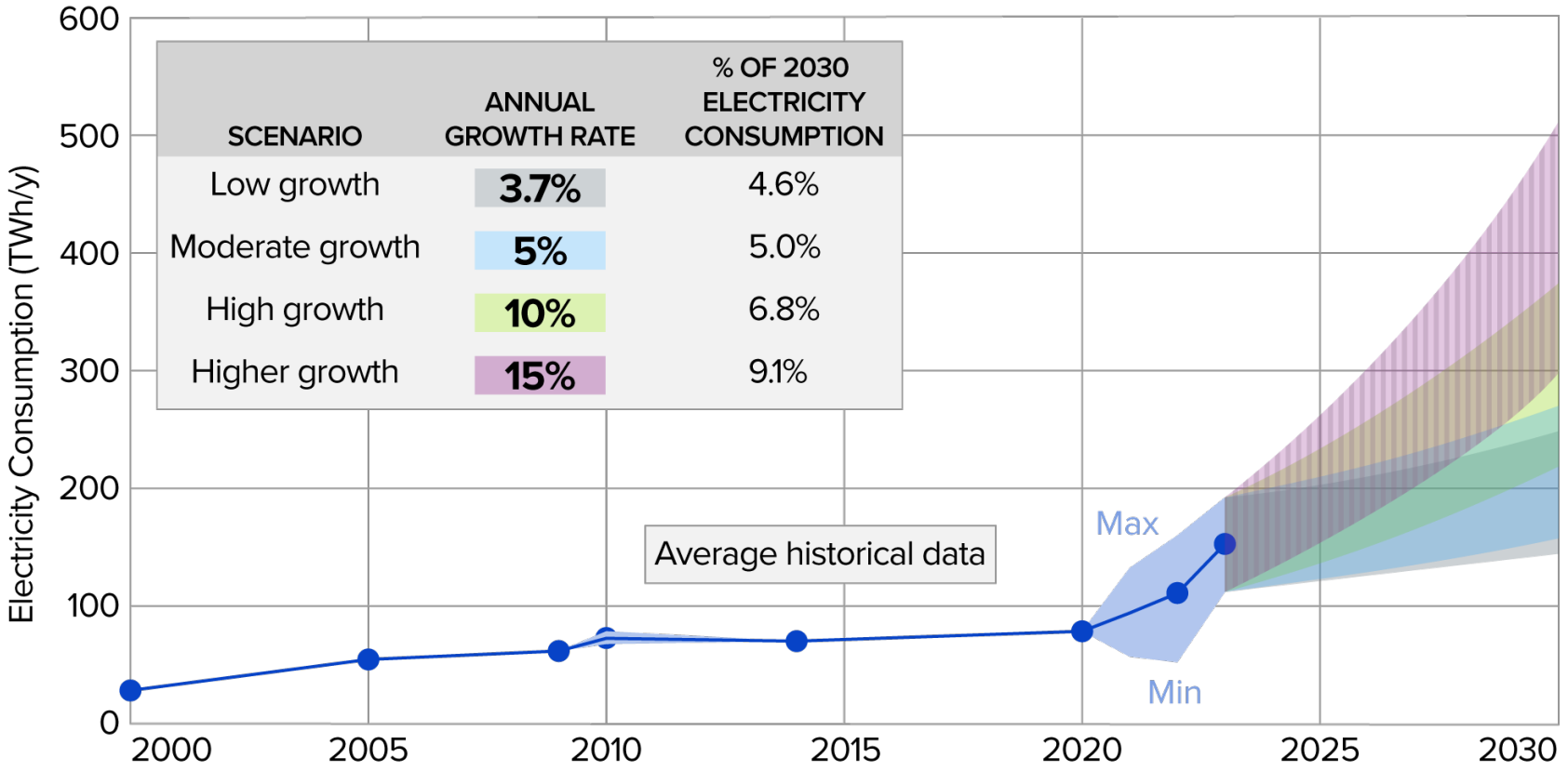
Source: Cushman & Wakefield Research, datacenterHawk, DC Byte, Structure Research

Site selection criteria:

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

Source: Cushman & Wakefield (2024)

U.S. Data Center Power Demands are Growing



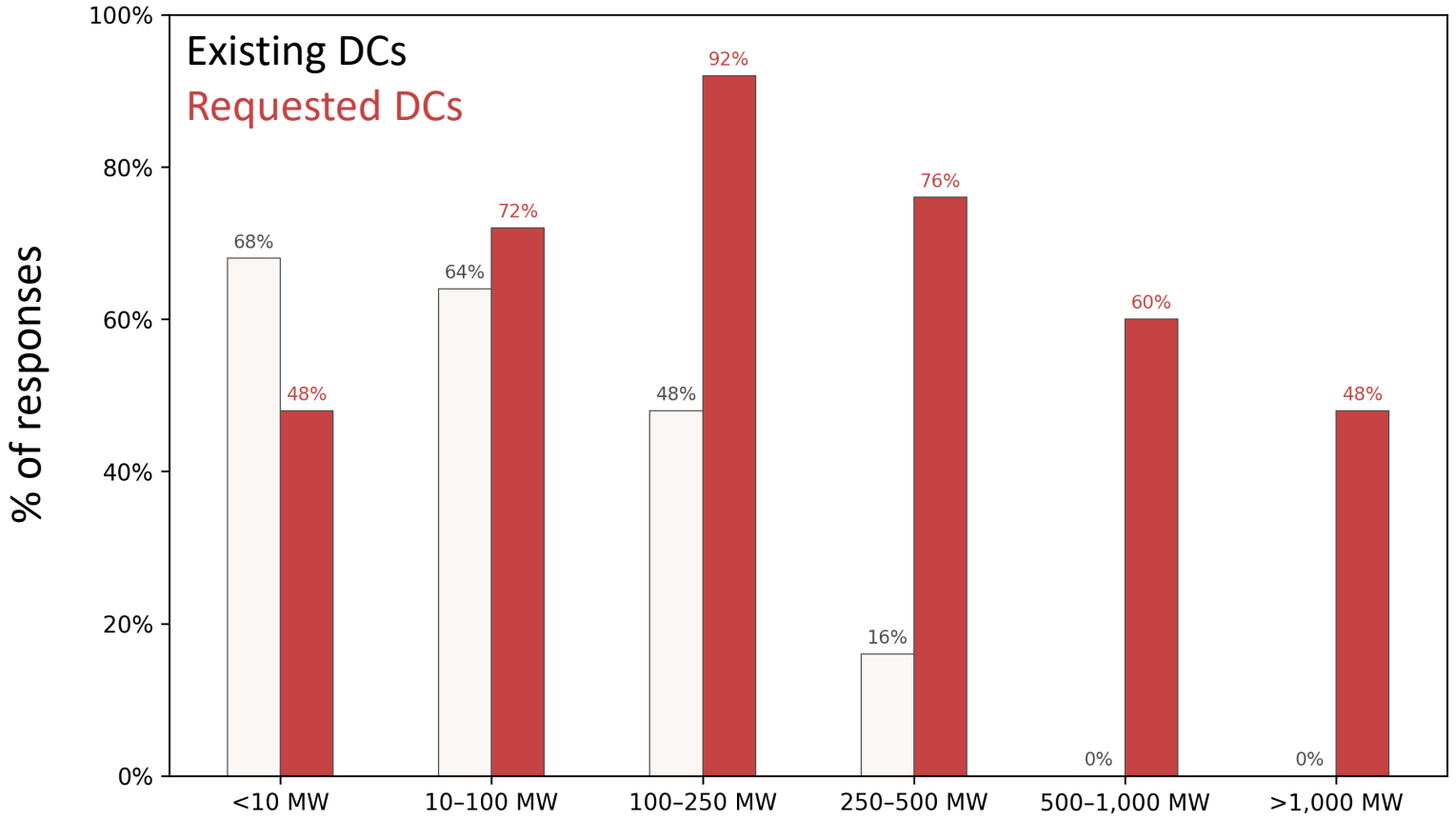
SCENARIO	ANNUAL GROWTH RATE	% OF 2030 ELECTRICITY CONSUMPTION
Low growth	3.7%	4.6%
Moderate growth	5%	5.0%
High growth	10%	6.8%
Higher growth	15%	9.1%

Key Themes in the Report

- History of data center load
- Drivers of recent and future growth
- Opportunities to reduce grid impacts
- Four scenarios for potential data center power demands in the U.S. through 2030

Source: EPRI Technology Innovation, *Powering Intelligence*, May 2024

Data Center Requests are Getting Larger (25 survey respondents)

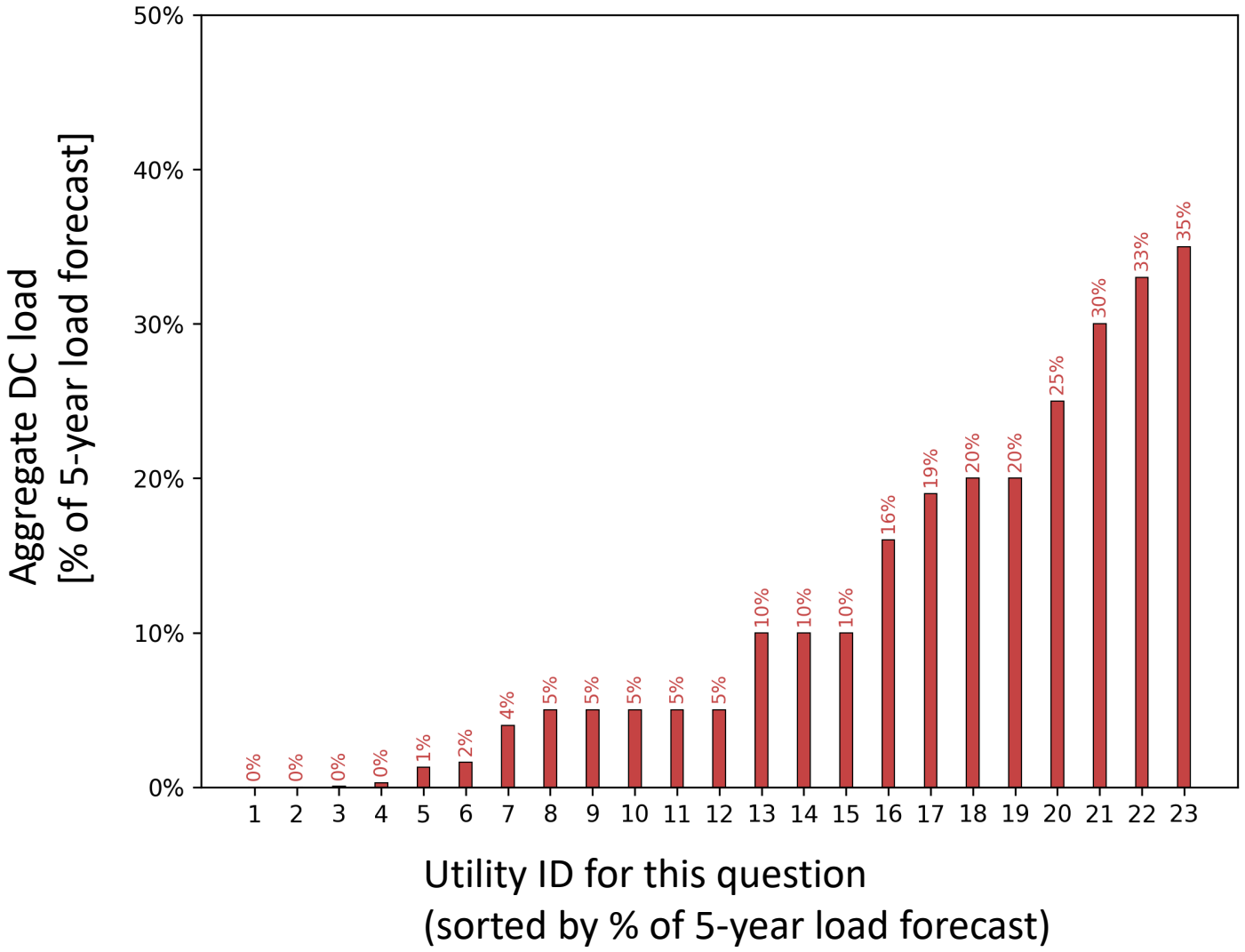


Key Points from Respondents:

- All operating data centers are <500MW
  - Most <100MW
- 60% have single requests for >500MW
- 48% have single requests for >1,000 MW

Source: "Utility Experiences and Trends Regarding Data Centers"
EPRI Load Forecasting Initiative (https://msites.epri.com/lfi), September 2024

Majority of responding utilities are projecting DC loads to be a significant portion of their peak load in 5-years



Out of 23 utility responses*:

- 48% predict that ≥10% of their peak load in 5-years will come from DCs
- 26% predict that ≥20% of their peak load in 5-years will come from DCs
- None of the utilities with aggregate DC requests ≥50% of their present peak load are forecasting DCs as >35% of their 5-year forecasted load

*2 utilities (out of the 25 total) did not respond to this question

Flexible Data Center Designs

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

Transformational Utility Programs

Explore program structures that equitably complement data center flexibility

Operational Flexibility Framework

Equip the utility industry planning practices to embrace large flexible loads

TOGETHER…SHAPING THE FUTURE OF ENERGY®

Powering Intelligence: Analyzing Artificial Intelligence and Data Center Energy Consumption

Utility Experiences and Trends Regarding Data Centers

Data Center Flexible Load Initiative

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