Powering the AI Era

Data Centers, Grid Resilience, and the Future of Energy Infrastructure

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Generation Sector – EPRI

SAME NoVA Post Webinar
22 September 2026

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Presentation Agenda

1. About EPRI
2. Data Centers, Simulation Centers, & DC Flex
3. Real Cybersecurity Challenges
4. Mitigating an Evolving Cyber Threat Landscape
5. Recap & Conclusion
6. Q&A

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About EPRI

EPRI Overview

- COLLABORATION
- CREDIBILITY
- EXPERTISE

Explore EPRI's research across the Nuclear, Generation, and Power Delivery and Utilization sectors ranging from decarbonization to grid modernization to low carbon resources.

Who We Are

Founded in 1972, the Electric Power Research Institute (EPRI) is the world's preeminent independent, non-profit energy research and development organization, with offices around the world.

Our Experts

EPRI's trusted experts collaborate with more than 700 utility members and 300 companies in 45 countries, driving innovation to ensure the public has clean, safe, reliable, affordable, and equitable access to electricity across the globe.

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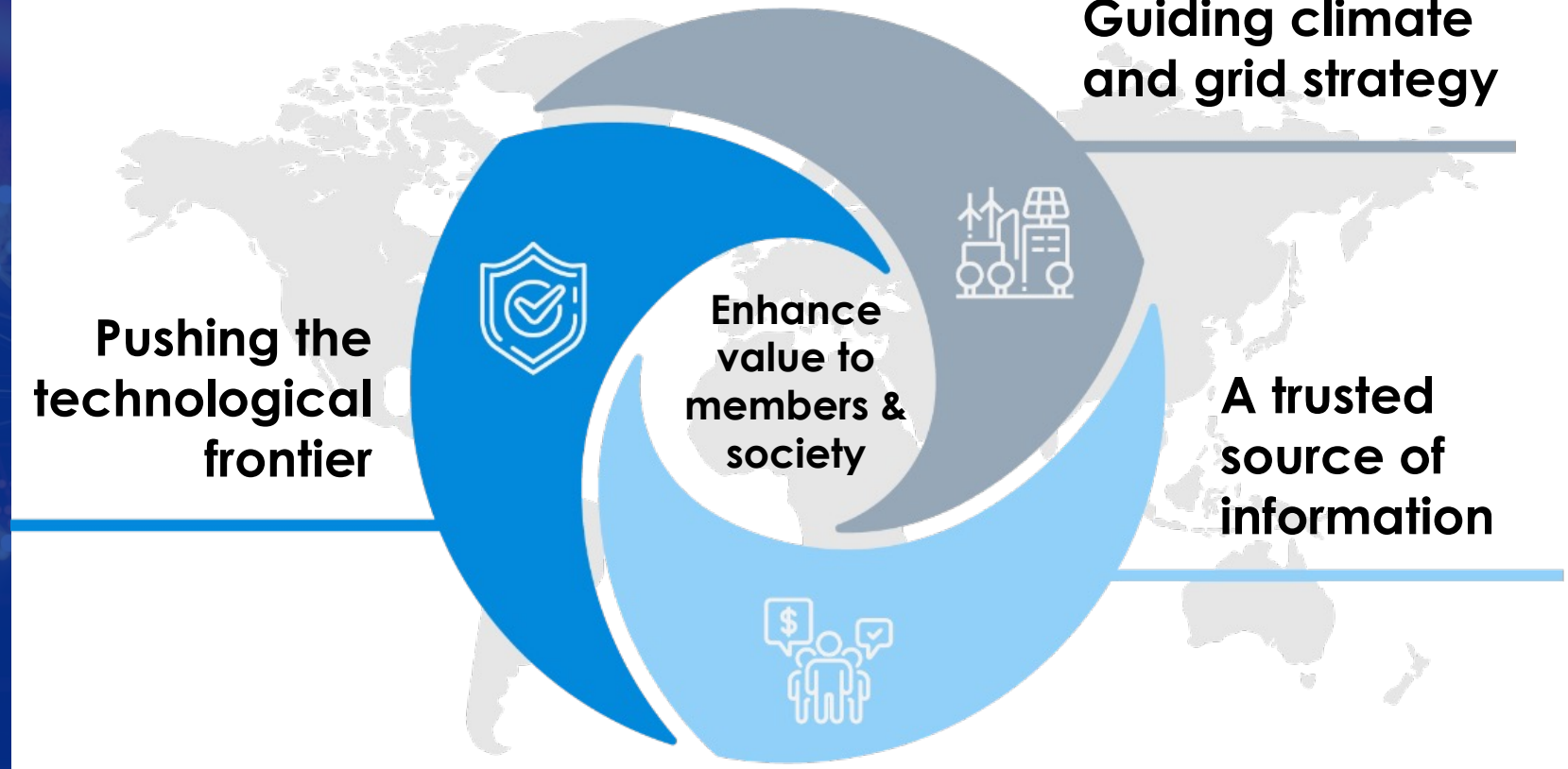
EPRI's Role

Industry, lawmakers, policymakers, thought leaders, regulators, financial community

Economy-wide modeling to optimize sustainability, reliability, and resiliency solutions

Develop and evaluate solutions while engaging national labs, technical partners, and international stakeholders



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EPRI Research & Development

Driving thought leadership, advanced R&D, and technology scouting and incubation to sustain a full pipeline of solutions

Technology Innovation

- Nuclear Power
- Energy Supply and Low-Carbon Resources
- Electrification and Sustainable Energy Strategy
- Transmission and Distribution Infrastructure
- Integrated Grid and Energy Services

Strategic Research

- Low-Carbon Resources
- End-Use/Economy-Wide Carbon Reduction
- Electric System Reliability/ Resilience
- Electric System Flexibility
- Market Transformation/ Policy/Regulatory Education

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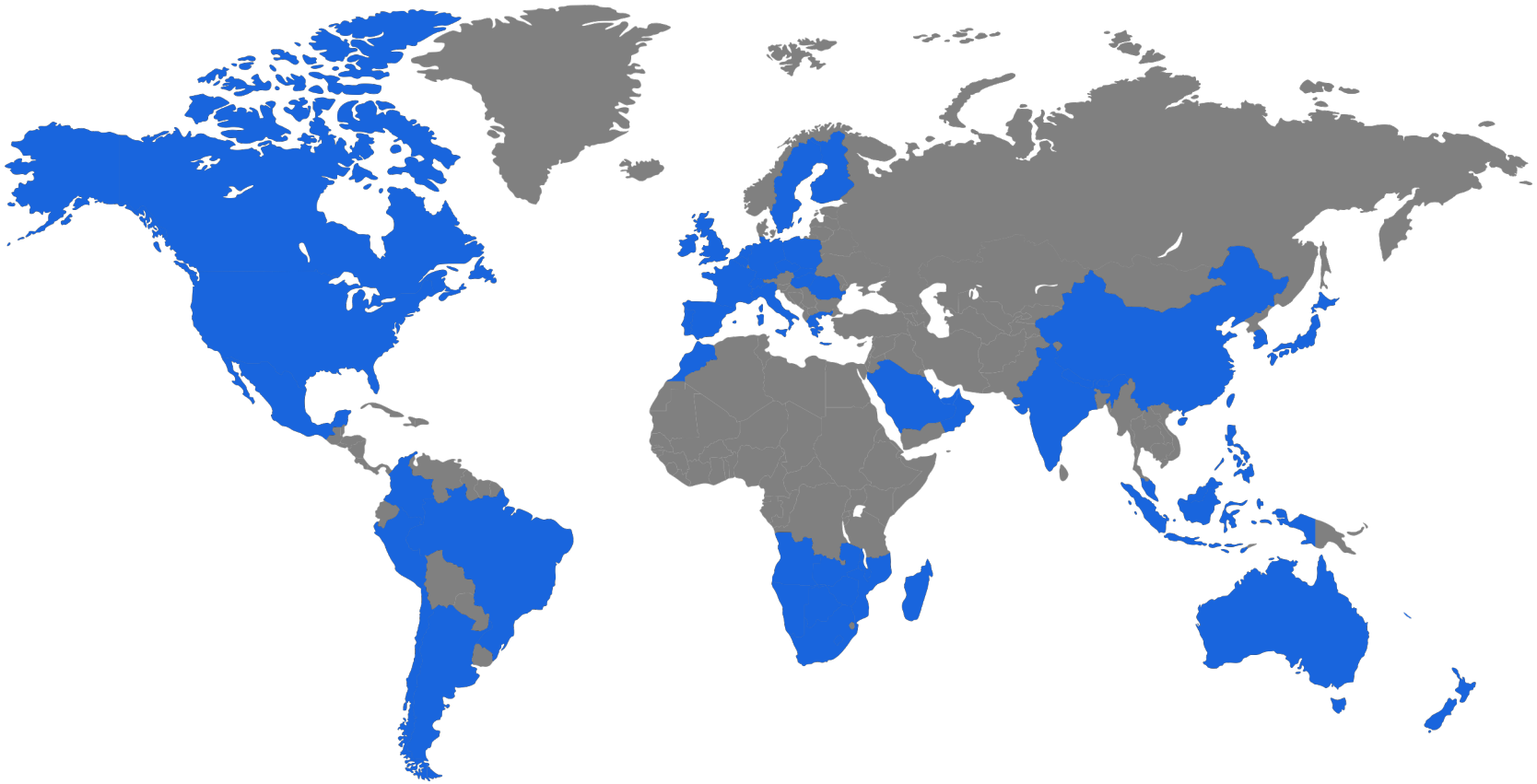
EPRI's Global Presence

45 Countries

700 Energy Companies



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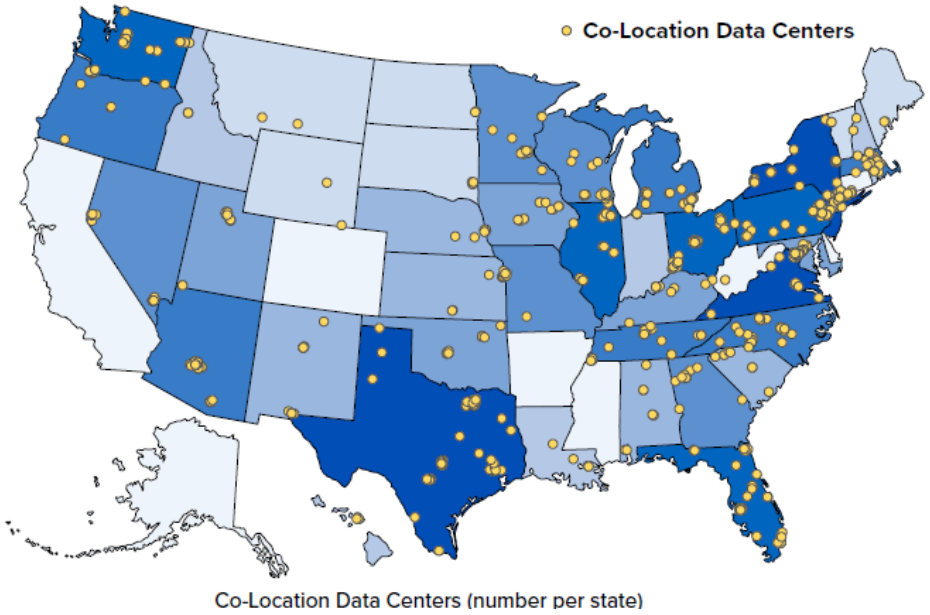
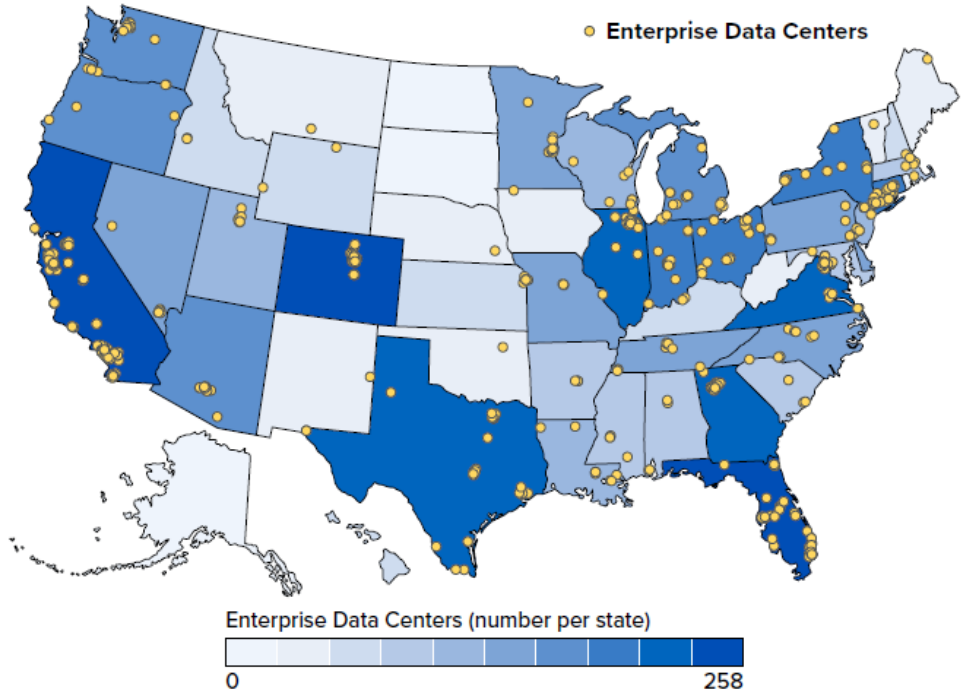
Data Centers, Simulation Centers, & DC Flex

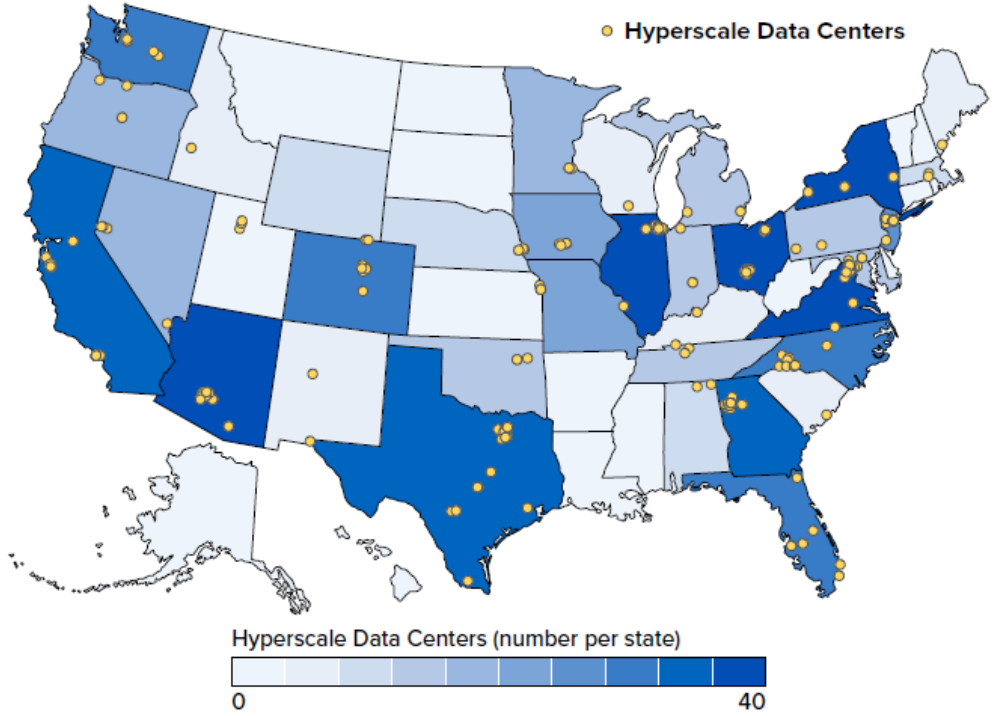
Data centers in the US

- 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







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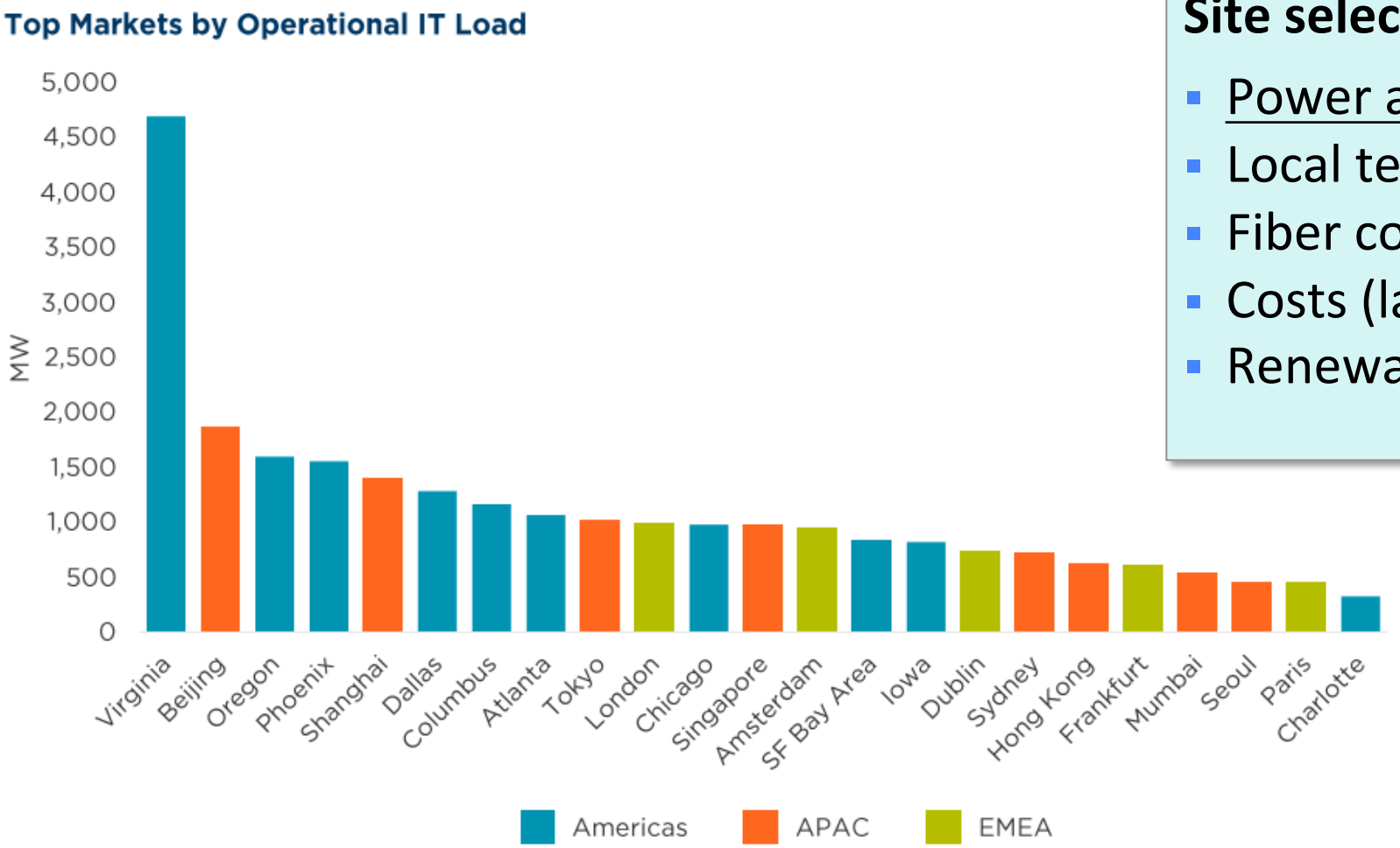
Data Centers Today are Concentrated Regionally … But are Spreading



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)

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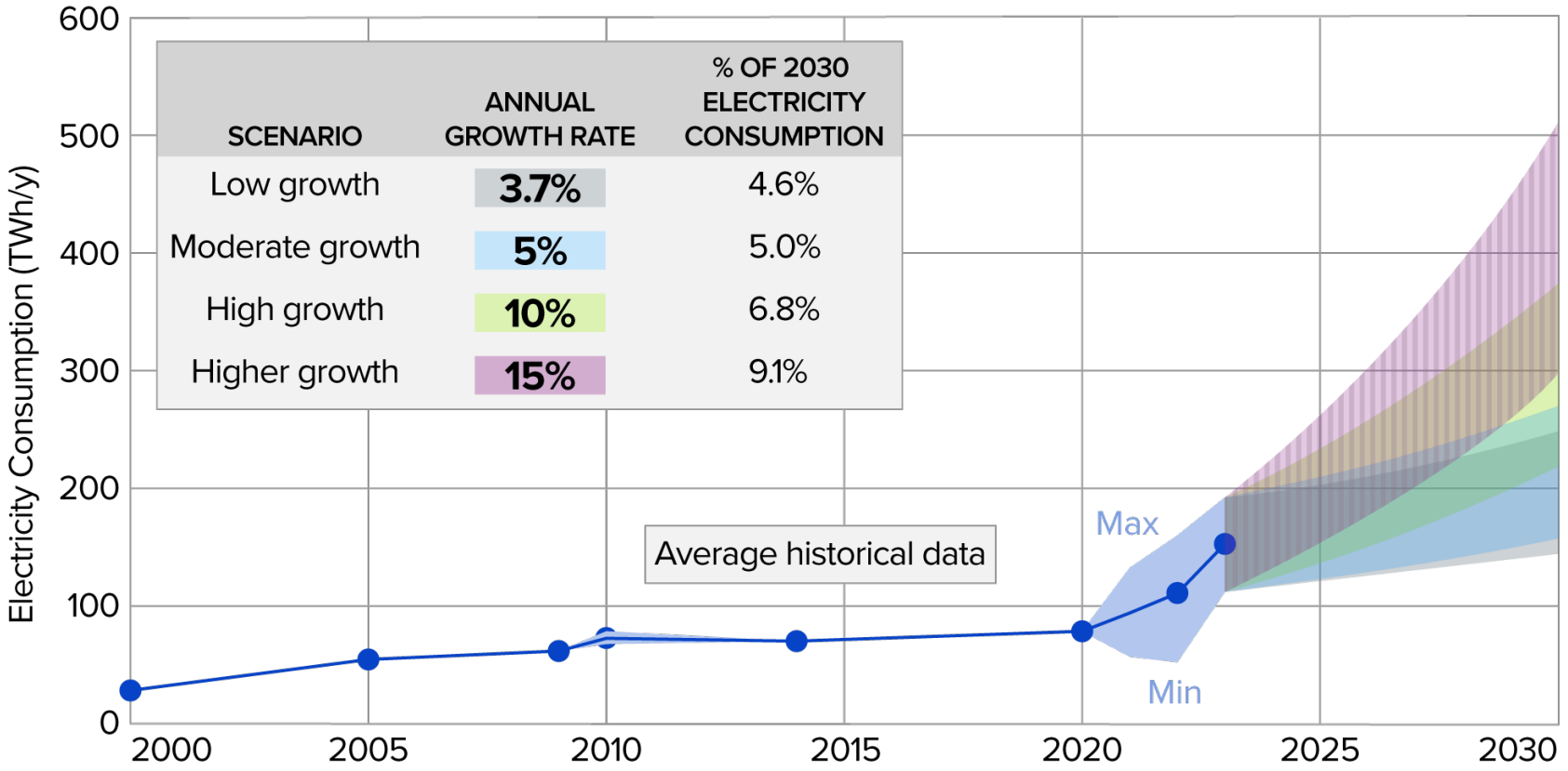
U.S. Data Center Power Demands are Growing



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

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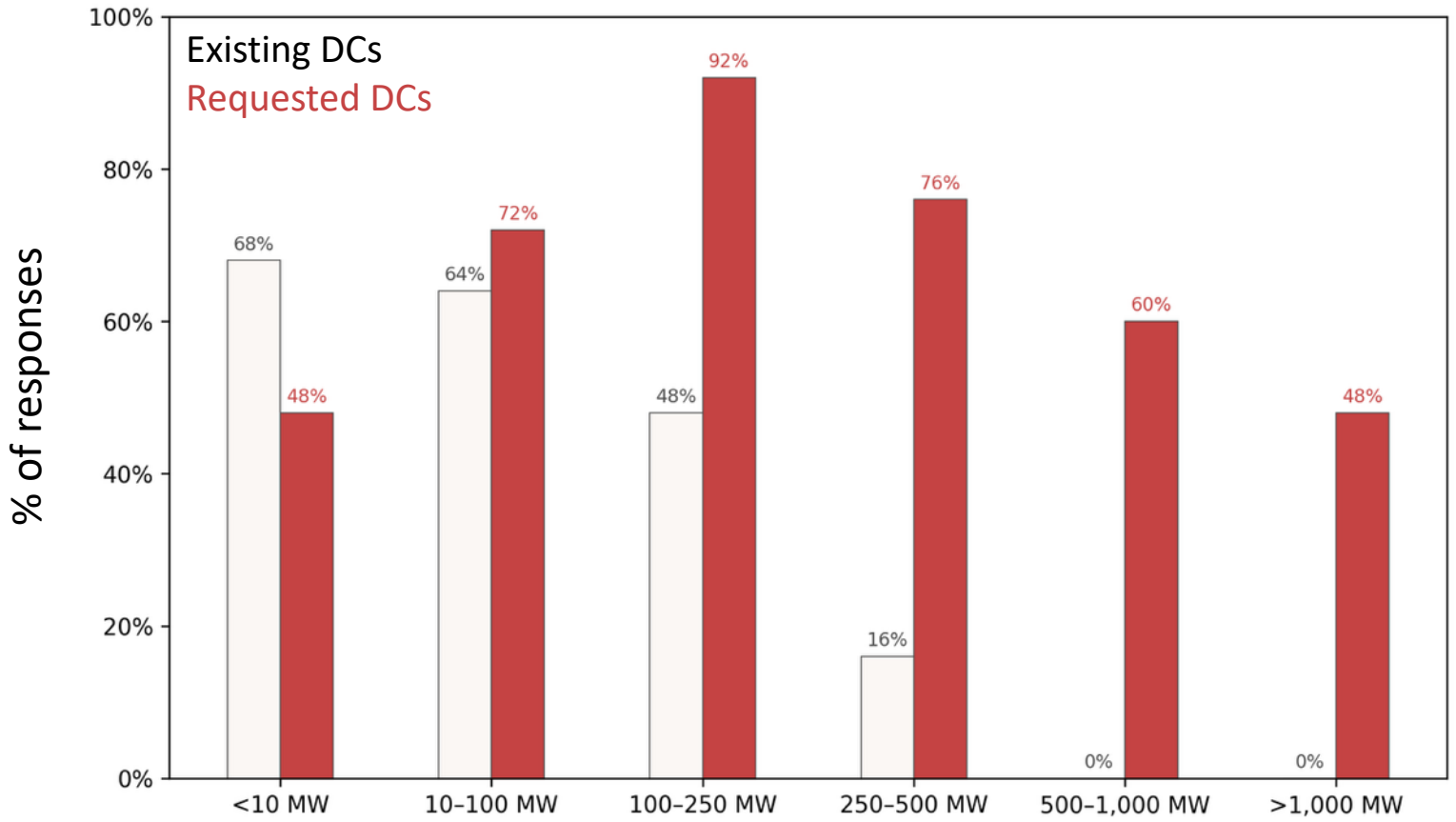
Data Center Requests are Getting Larger (25 survey respondents)



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

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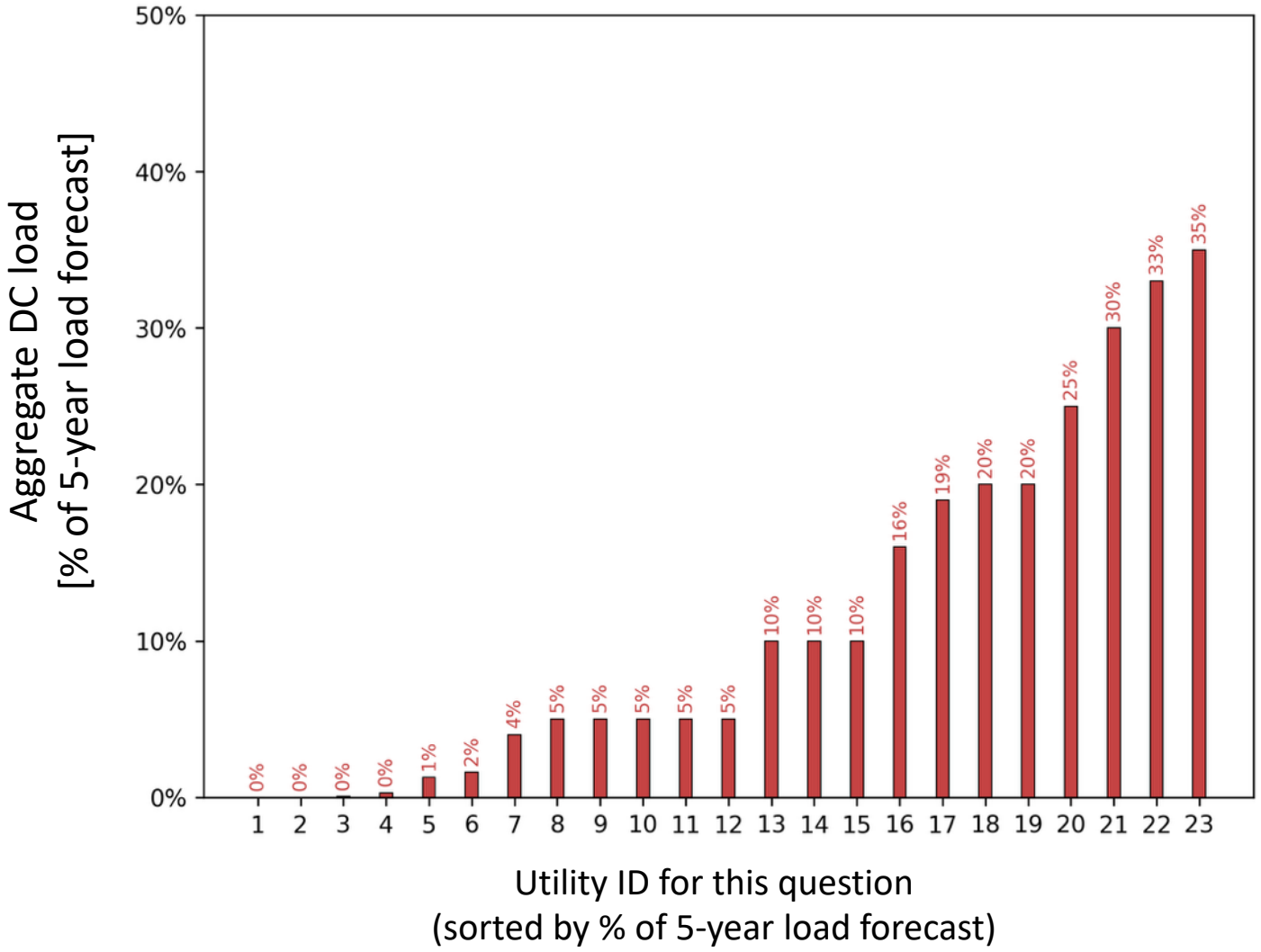
Majority of responding utilities are projecting DC loads to be a significant portion of their peak load in 5-years



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

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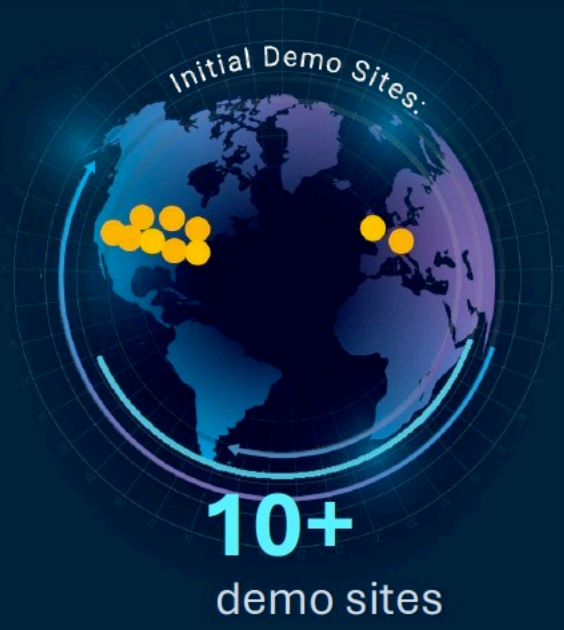
DCFlex Optimize Data Center Operational Flexibility to Help Strengthen the Grid



10+
demo sites

- ARIZONA, U.S.
- NORTH CAROLINA, U.S.
- PARIS, FRANCE
- VIRGINIA, U.S.
- ILLINOIS, U.S.
- TEXAS, U.S.
- LONDON, U.K.

DCFlex Workstreams

01 Flexible Data Center Design

02 Transformational Utility Programs

03 Interconnection Practices

04 Planning & Portfolio Readiness

05 Distribution Data Centers

The DCFlex participant panel actively collaborates with regulators, academia, and industry stakeholders – both to share leading practices and insights, and to incorporate diverse perspectives that strengthen the initiative's direction and impact.

Learn More:
dcflex.epri.com

FLEX MOSAIC

Deliver a large load flexibility framework bridging data center capability to grid needs

EPRI

DCFlex Participants

Developers

COMPASS datacenters
QTS

Hyperscalers

Google
Meta
Microsoft

IPP's

CALPINE
Chevron
Constellation
nrg
RWE
VISTRA

ISO/RTO

California ISO
CENACE
ercot
ieso
ISO new england
smart KPX
MISO
NESO
pjm
SPP Southwest Power Pool

Technology Providers

CATERPILLAR
JENBACHER
KRAKEN
LS Cable
NVIDIA
PADO
Schneider Electric

Advisory & Finance

EY
ING
KPMG

Engineering & Construction

CRIEPI Central Research Institute of Electric Power Industry
QUANTA
Ulteig
wesco

Utilities

aes
Alliant Energy
aps
Bonneville Power Administration
AEP
Dominion Energy
DTE
DUKE ENERGY
ESB Energy for generations
East Kentucky Power Cooperative
ENOWA NEOM
entergy
exelon
Georgia Transmission
ICEPCO
LES
LCRA
nationalgrid
Nebraska Public Power District
NEW YORK STATE OF OPPORTUNITY NY Power Authority
OglethorpePower
PGE
ppl
PSEG
REC Rayburn Electric
Rte
SRP
Southern Company
TVA
TENNESSEE VALLEY AUTHORITY
UNITED POWER Your Touchstone Energy® Cooperative

Not Pictured | SHELL

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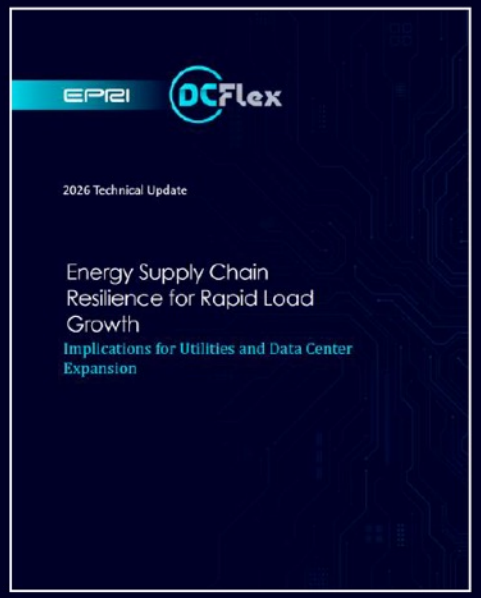
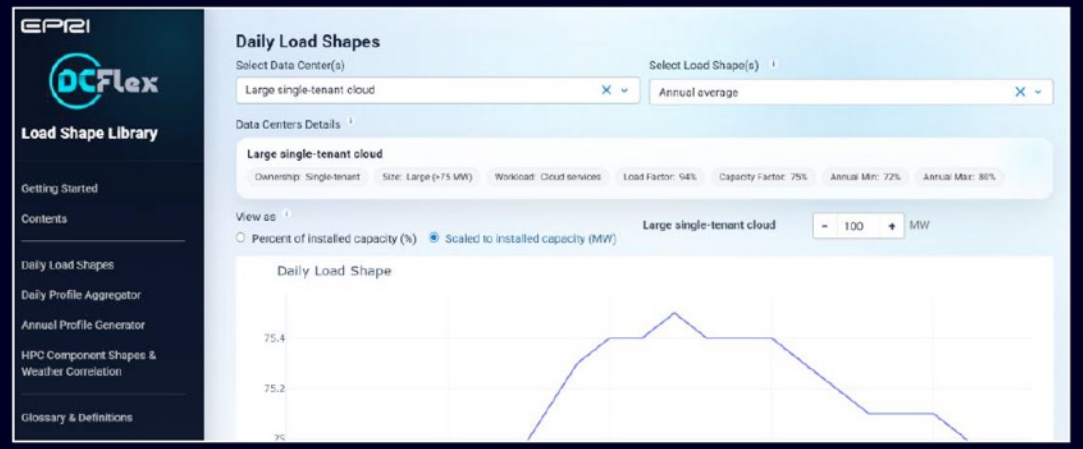
DC Flex Workstreams

- WS 1: Gird-Informed Flexible Data Center Design
- WS 2: Transformational Utility Programs
- WS 3: Interconnection Practices
- WS 4: Planning and Portfolio Readiness
- WS 5: Distribution-Connected Data Centers
- WS 6: Demonstrations





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Real Cybersecurity Challenges

(Jason's) Top 3 Cybersecurity Challenges

Supply Chain

- Digital Supply Chain
- Hardware / Software Bill of Materials
- Rogue or Undocumented Devices

Secure Remote Access

- Employee Access
- Vendor / Trusted 3rd Party Access

Exposure Management

- Vulnerabilities
- Patching
- Cloud

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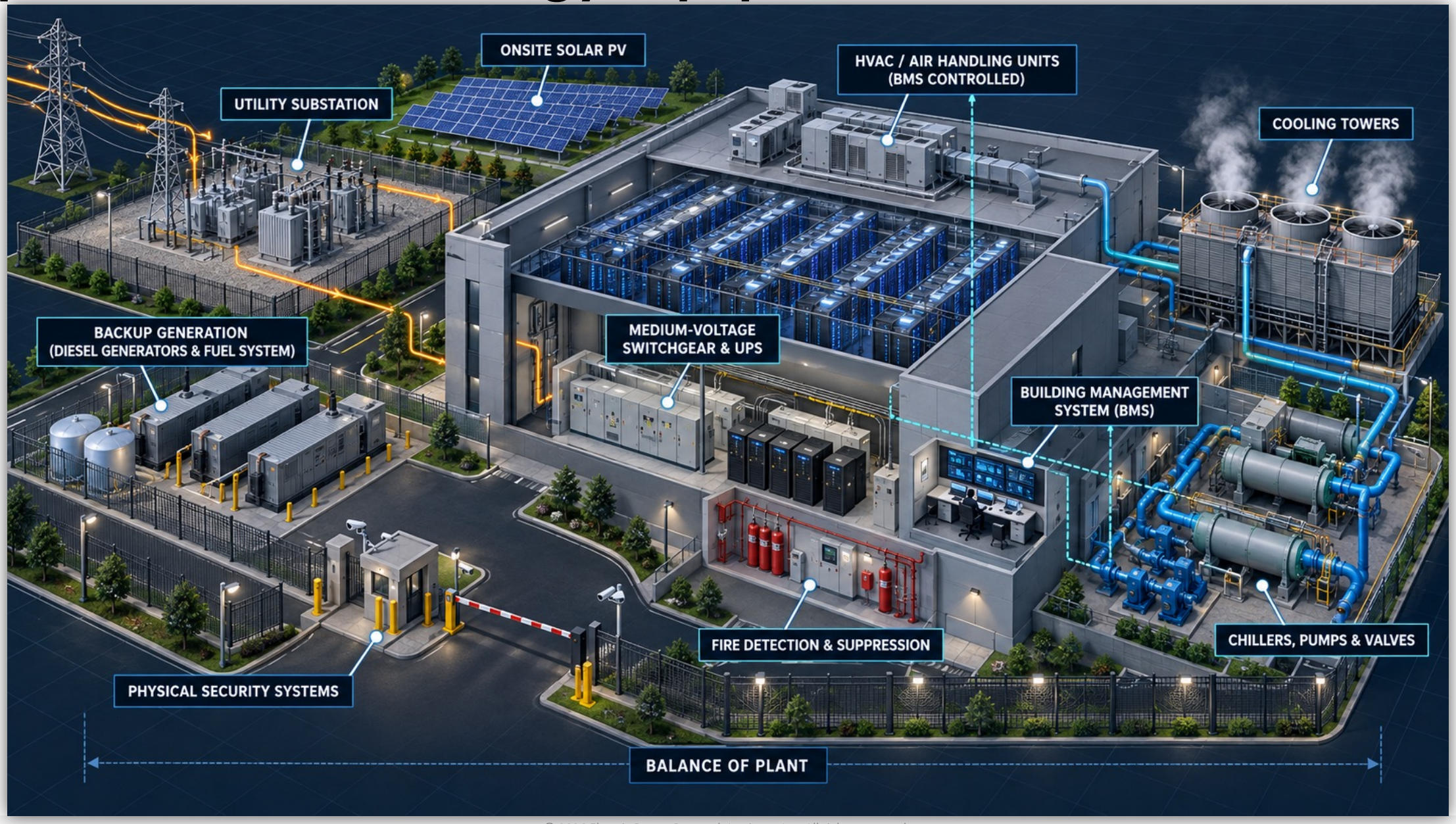
Operational Technology Equipment at a Data Center



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Supply Chain Attacks

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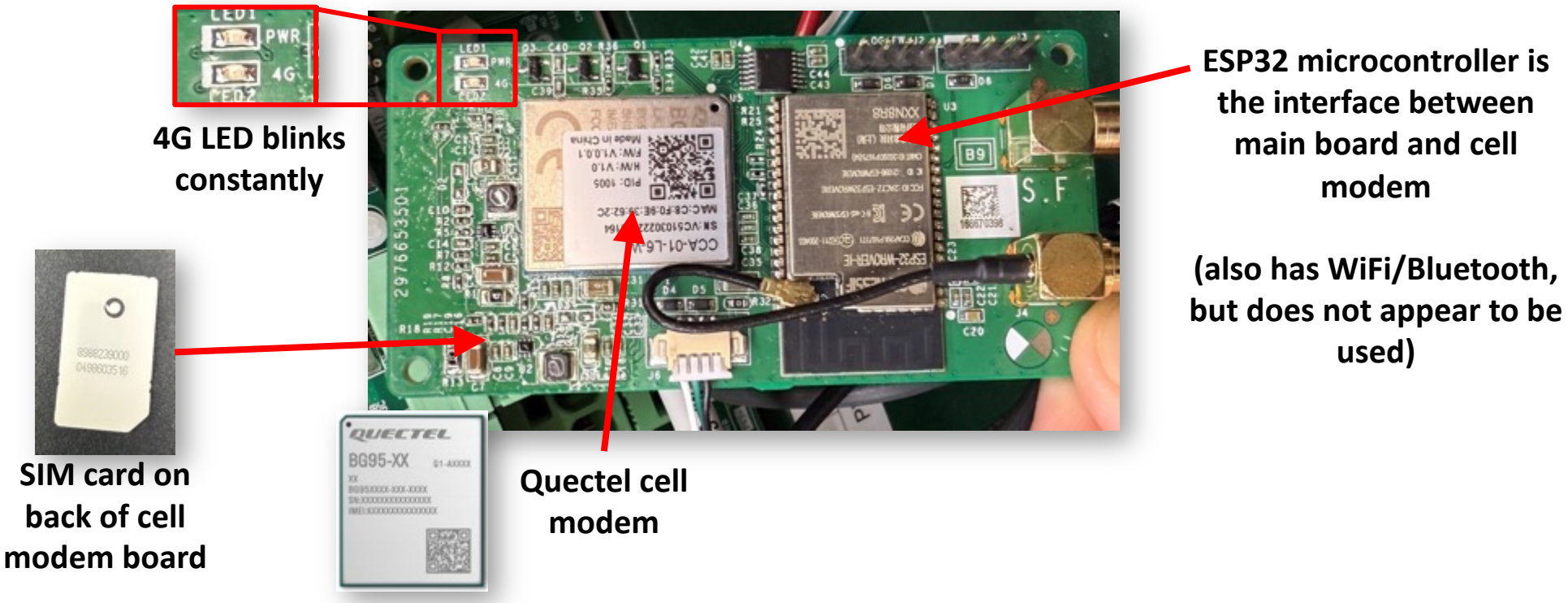
Cellular Modem – Verification of Manufacturer Claims

- Manufacturer confirmed the equipment **does not ship with a cellular modem**
  - In-house equipment contained hardware board containing a cell modem (and a WiFi/Bluetooth chip) on a single board; a SIM card was installed
  - Cell modem is a Quectel BG95-M1 (an LTE Category M1 using IoT bands); it also has GPS
- Can observe attempts to establish connection to a cellular tower



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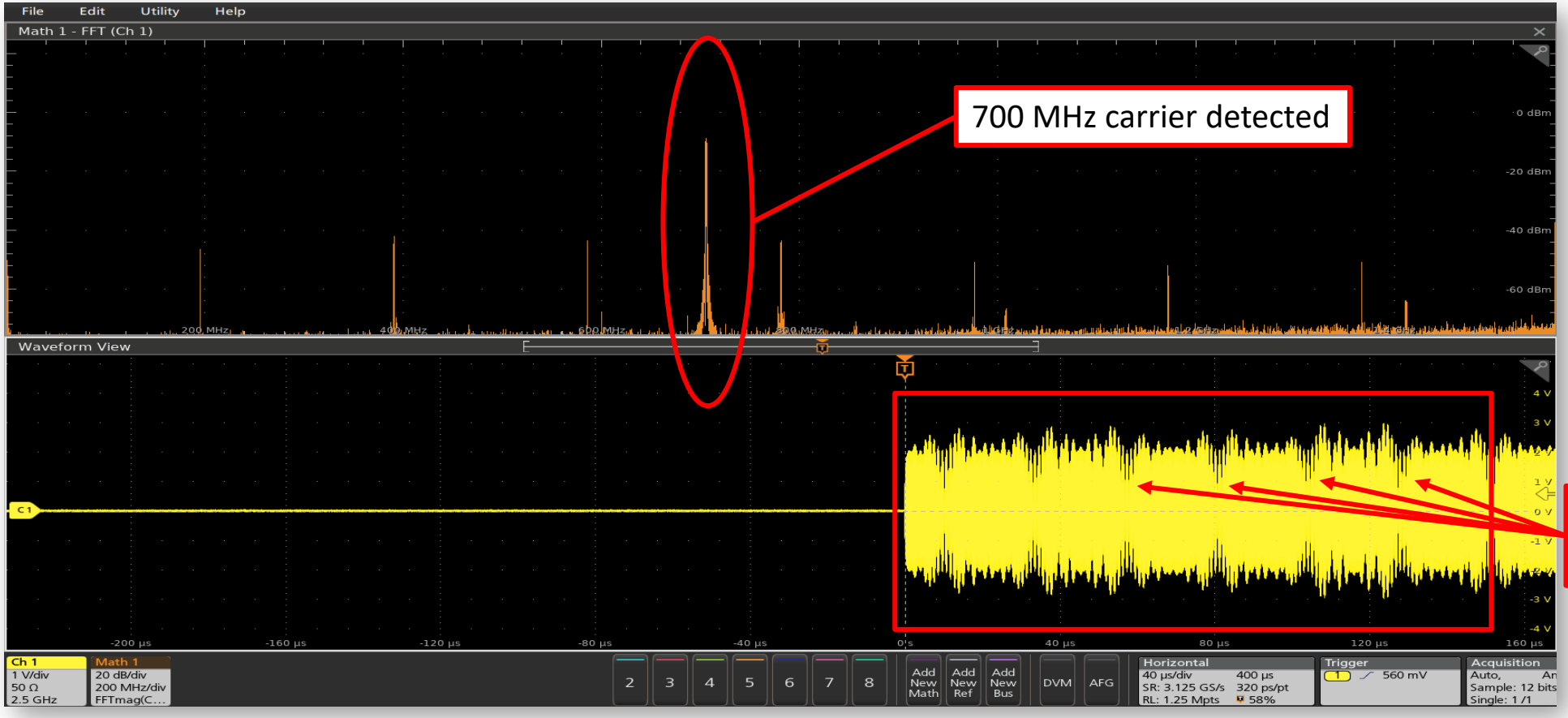
Confirmation of a Cellular Modem Attempting Communication

- Cell modem antenna feed analyzed by high frequency oscilloscope with FFT capabilities
- The presence of a strong 700 MHz signal aligns with the specs of cell modem (700 MHz is the carrier frequency for CAT M1 LTE)
- This signal is only present when the equipment is powered on



The measurement of a signal from the modem (***activity***) does not mean ***connectivity*** to a cellular network

Time series data exhibits modulation

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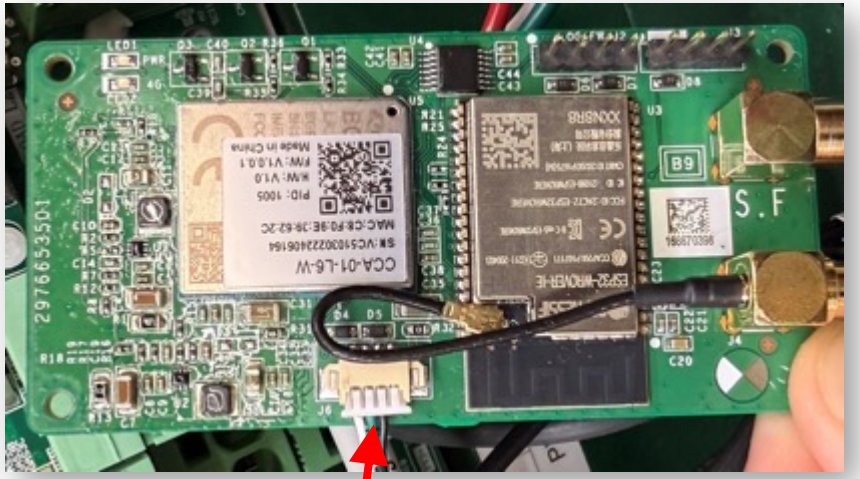
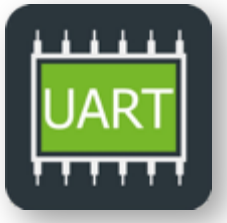
Communications Between Main Controller & Cellular Board

- Suspected UART comms detected on serial lines between the main controller board and the cellular board



Serial data lines



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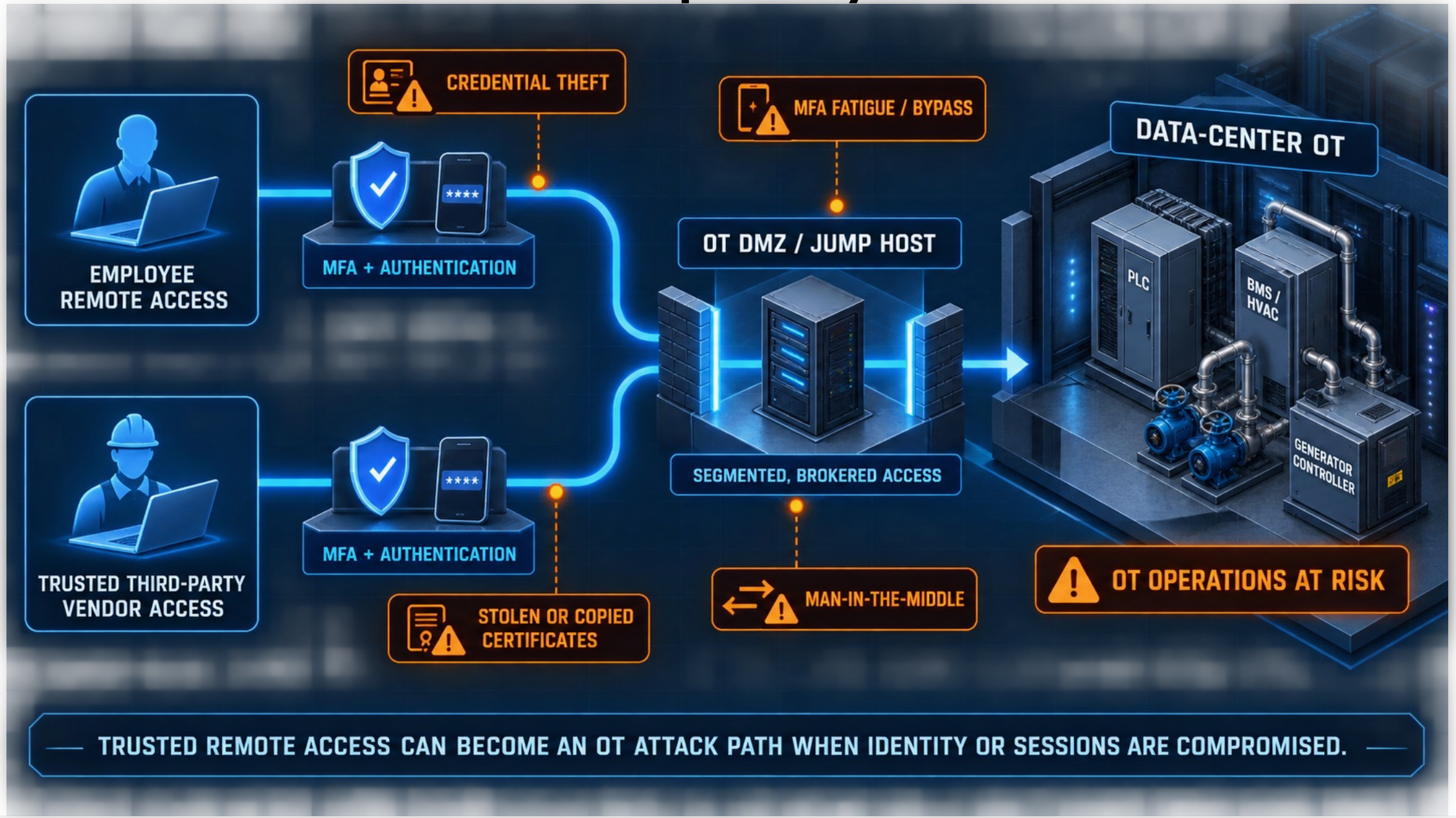
Secure Remote Access Capability



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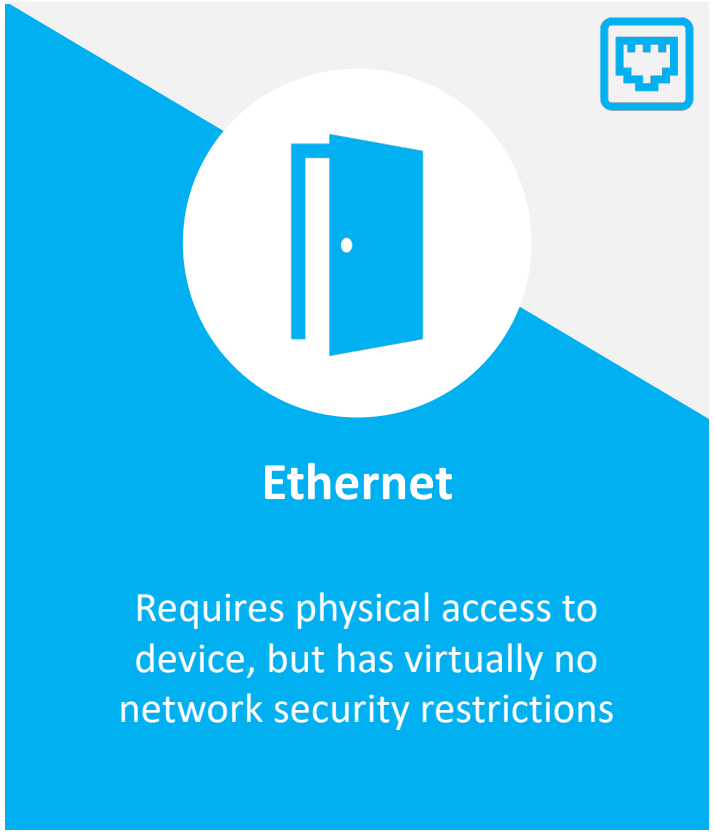
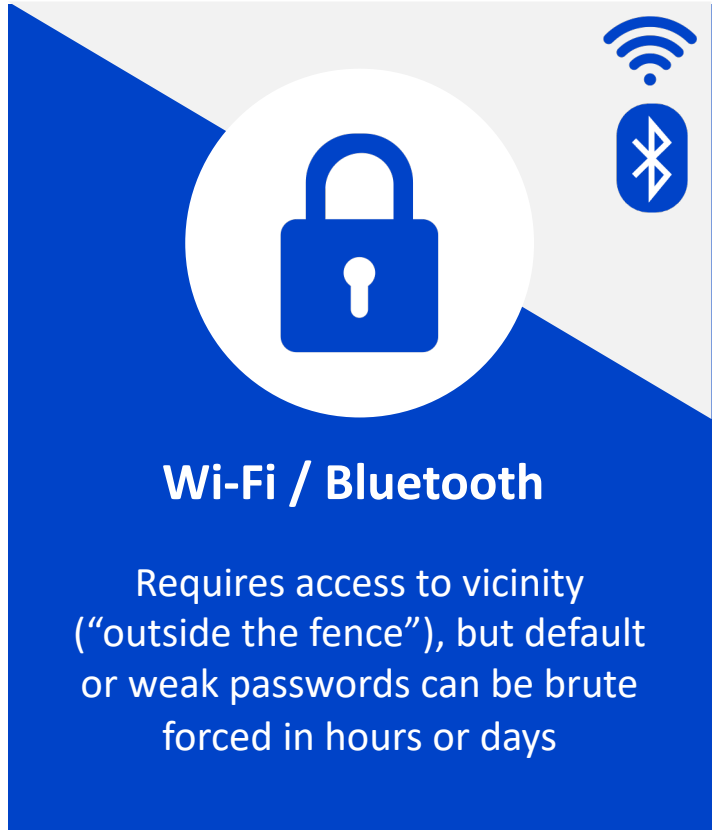
Secure Remote Access – Theft, Modification, Control



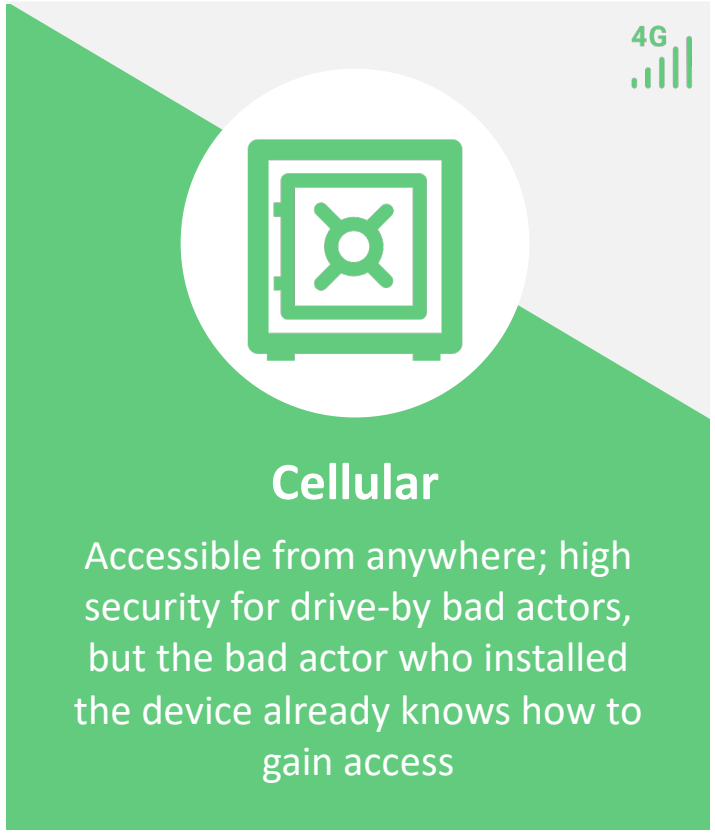
Ethernet

Requires physical access to device, but has virtually no network security restrictions



Wi-Fi / Bluetooth

Requires access to vicinity (“outside the fence”), but default or weak passwords can be brute forced in hours or days



Cellular

Accessible from anywhere; high security for drive-by bad actors, but the bad actor who installed the device already knows how to gain access

Common Access Plane: Once inside the device, command and control can be easy (through Web-based or Modbus commands)

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Exposure Management

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Lessons Learned for OT Systems

Vulnerabilities, Configurations, and Cyber Hardening

No apparent, effective protections against credential guessing (lockout, throttling, alerting)

Security posture assumes trusted deployment environments

Outdated firmware can increase attack vectors due to identified vulnerabilities

Wireless Access Expands Beyond the Fence Line

WiFi/Bluetooth require proximity; cellular removes geographical constraints

Wireless channels increase exposure to drive-by, insider, and staged attacks

Undocumented Communications Undermine Trust Assumptions

Manufacturer security assurances cannot be validated without full hardware transparency

Hidden and undocumented connectivity increases supply chain, installation, and lifecycle security risk

Wireless communications can create a bypass to monitored channels

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Mitigating an Evolving Cyber Threat Landscape

AI-AIDED VULNERABILITY DISCLOSURE: OT-RELEVANT SIGNALS

Platform data shows AI expanding what researchers can test, discover, and submit. The data below is not an OT-only count.

VALID AI VULNERABILITY REPORTS

210%

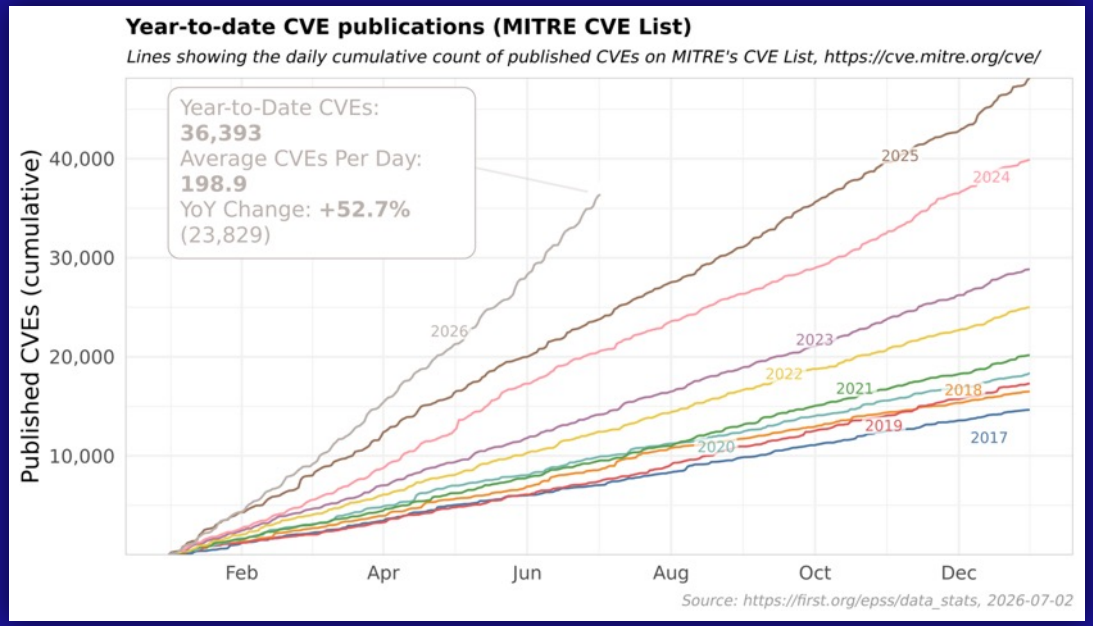
year-over-year growth

HackerOne reports that valid AI vulnerability reports grew 210% in 2025.

Prompt-injection reports rose 540%, its fastest-growing AI attack vector.

Source: HackerOne, Hacker-Powered Security Report 2025

INDEXED GROWTH IN VULN REPORTS



MICROSOFT CLOUD + AI SIGNALS

180 new vulnerabilities Microsoft says researchers proactively discovered in cloud and AI.

600+ vulnerability submissions in Microsoft's 2025 Zero Day Quest for Copilot and Cloud.

17M dollars Microsoft paid in 2025 to 344 researchers across its bounty programs.

Sources: Microsoft Secure Future Initiative, Apr. 2025; Microsoft Bounty Program, Aug. 2025.

OT IMPLICATION | Windows-based engineering workstations, SCADA/DCS servers, and their supporting services face a faster discovery and disclosure cycle.

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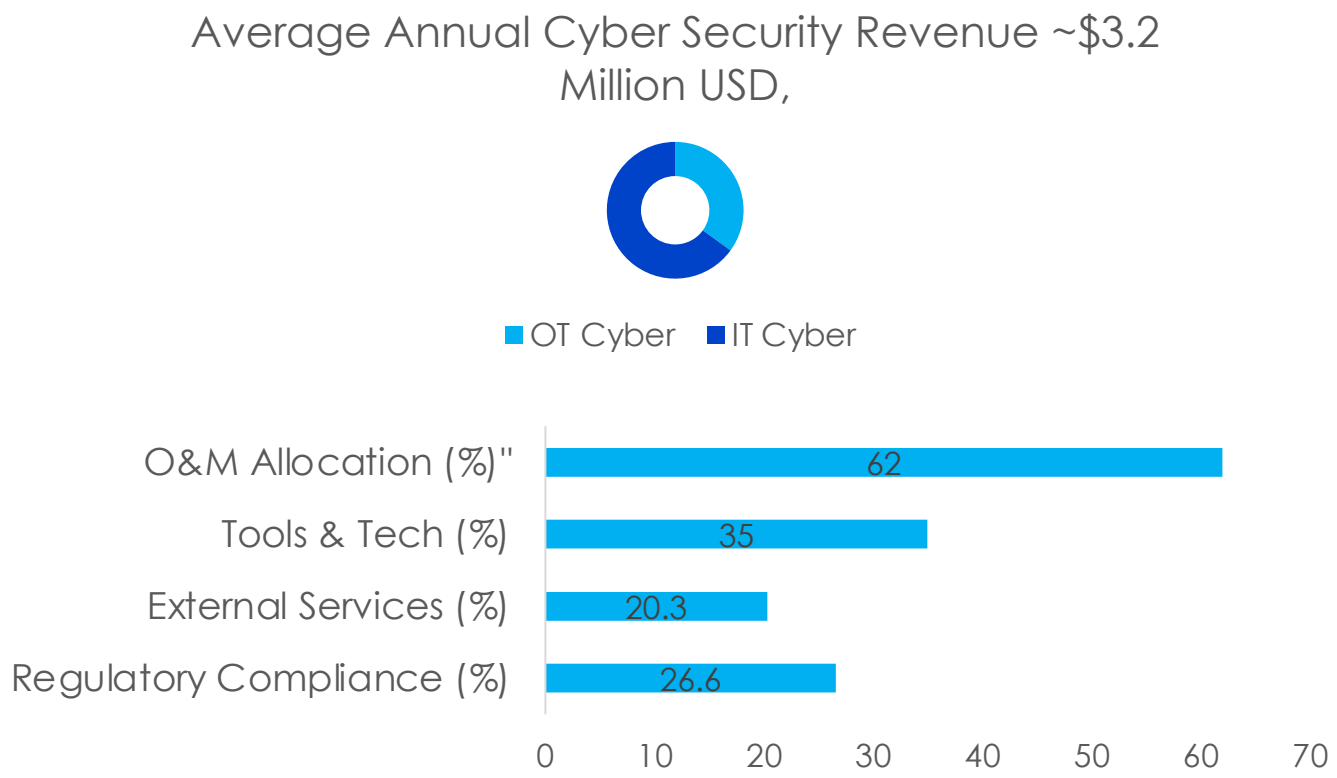
Cybersecurity Budgets and Spend

~$3.2M
Average annual cyber budget (1.0% of revenue)

2.5×
Increase vs. 0.4% of revenue in 2022



Budget composition

35% OT share of cyber spend, up from 33% in 2022.

OT vs. IT allocation

OT share: 35.5% | IT share: 64.5%. OT security is no longer a blind spot, with budgets aligning to converged IT/OT threat models.

Source: EPRI, epri.com/research/programs/112046/results/3002032597

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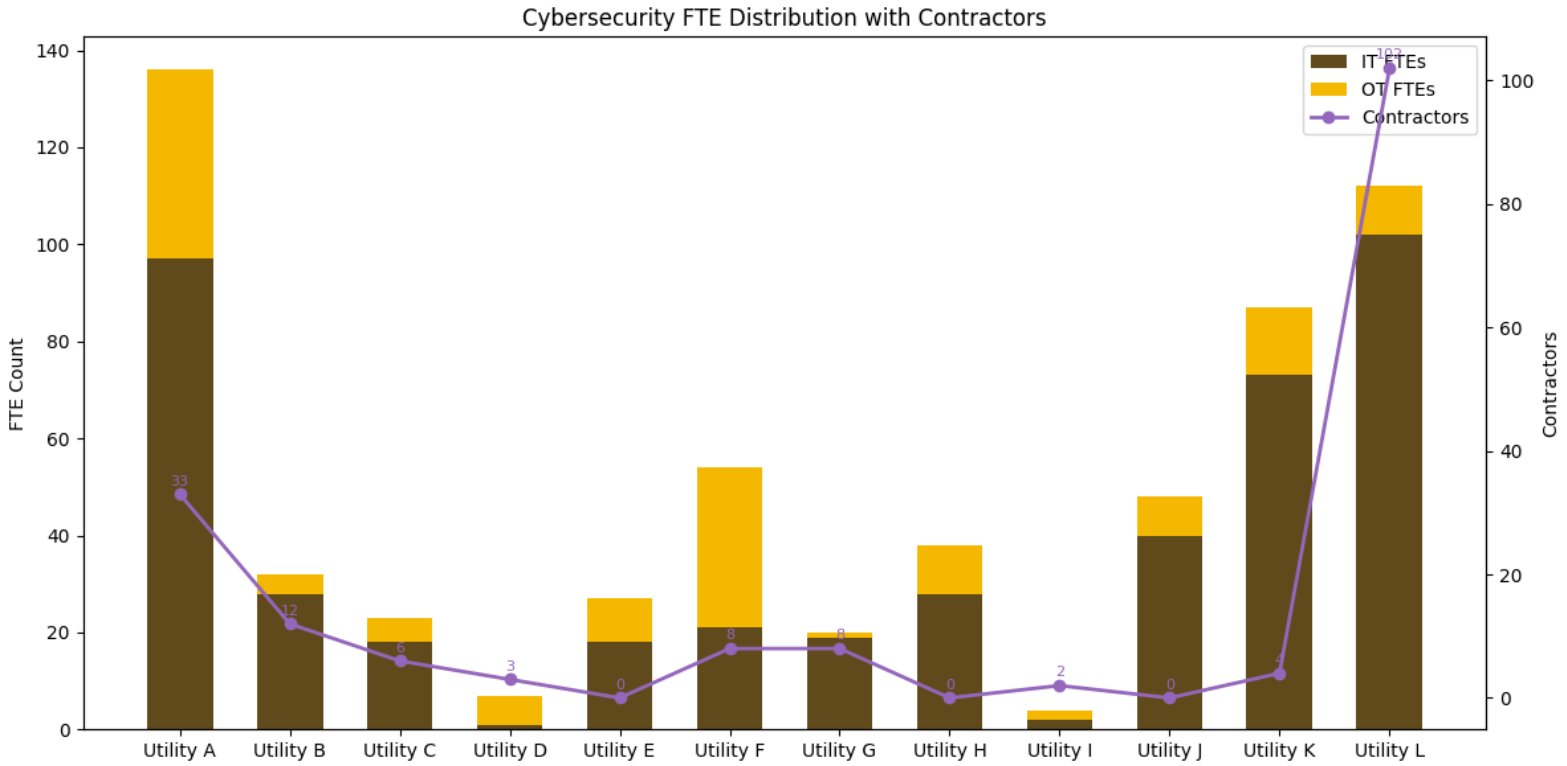
FTE Distribution Highlights IT Dominance and Contractor Reliance

Cybersecurity FTE distribution with contractors, across utilities



Source: EPRI, epri.com/research/programs/112046/results/3002032597

IT FTEs dominate over OT

In almost every utility, IT FTEs are the majority of cybersecurity staff; OT FTEs are present but often under 20 — the ongoing challenge of building specialized OT capacity.

Contractor reliance is uneven

Utility L and Utility A report over 100 contractors while many report zero — two distinct models: contractor-heavy surge capacity, or in-house employees.

Small utilities lean on FTEs

For smaller and mid-sized utilities, contractor counts are near zero.

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The Baseline

Digital asset management starts with knowing what we have.

Digital Asset Management

Know what you have. Walkdowns. Process + Data Model. Tooling. [1]

Technology Debt

Modernization needed.

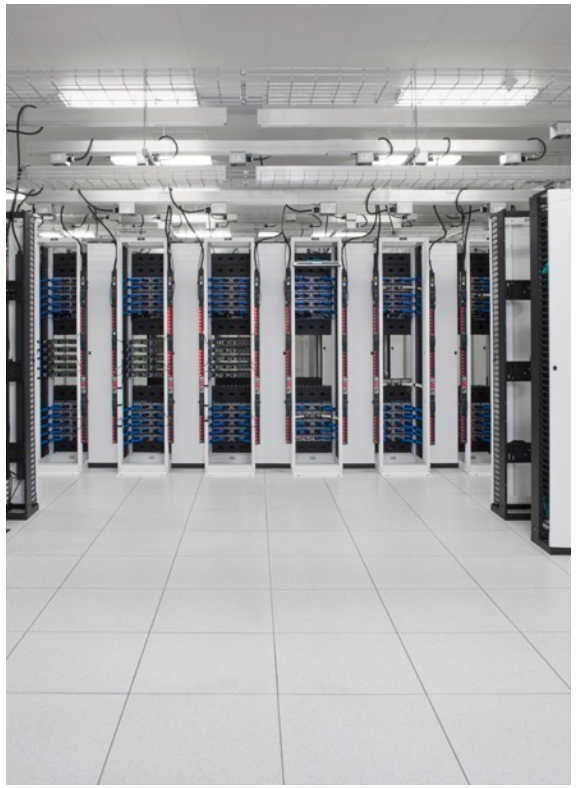
Hardening

Remove unused ports/service, change defaults.

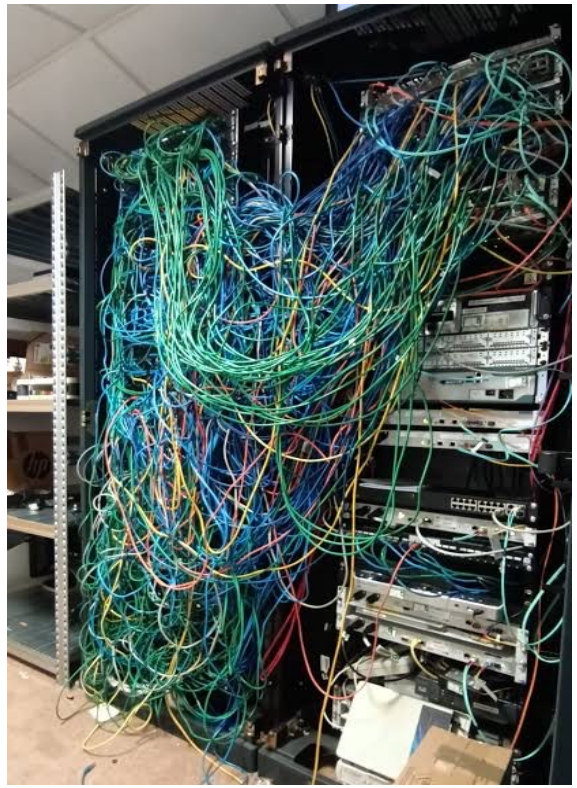
Applied Baseline Controls

Standard cybersecurity controls across all sites and assets.

HOW WE DESCRIBE IT



WHAT WE REALLY HAVE



The gap between the described environment and field reality is where risk and effort accumulate.

[1] https://www.epri.com/research/programs/112046/results/3002032603

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Mitigations

Accurate asset inventory.

Walkdown and investigation for situational awareness.

Develop a plan.

- Remove or disable unutilized wireless communication.
- Document and secure existing wireless communication that is being used.

Develop a process to inspect new technologies for undocumented wireless communication during commissioning.

Develop a process for site turnover from 3rd parties, integrators, or vendors.

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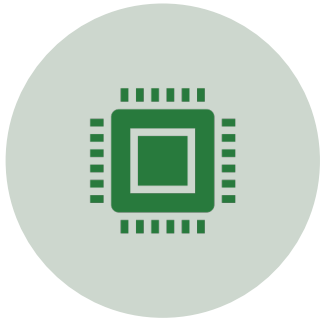
Recap & Conclusions

The Future of Energy Infrastructure

Supply chain constraints will force a larger reliance on global supply.

Critical infrastructure equipment and controls will be managed with cloud services.
AI-supported attacks will continue.



Additional required buildout to meet AI inference and training demand will drive a bow wave of increased security issues.

Continued near-term and long-term shortage of OT cyber security staff.

Compounding to increased cybersecurity risk for *Energy* and *Data Center* assets

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What We've Covered

And What You've Learned

01 **Data Centers**
Load is growing fast!

02 **Data Center OT Cyber Risk**
Cyber risk is real and proven.

03 **Cyber Risk Mitigation**
Visibility, access control, and hardening baseline controls are paramount.

04 **Planning and Preparation**
Planning for growth with increased cyber capabilities is critical

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About the Presenter

jhollern@epri.com

Jason Hollern is a Technical Executive in the Digitalization Area within the Generation Sector at the Electric Power Research Institute (EPRI).

Mr. Hollern's current research areas include industrial control system (ICS) cyber security and artificial intelligence. He also leads the cross-sector cyber security research and coordination between Energy Delivery and Customer Solutions, Generation and Low-Carbon Resources, and Nuclear cyber security programs. He has led generation-specific cyber security research and development at EPRI since 2017.

At EPRI, he leads a multi-disciplinary team of engineers and researchers to provide applied solutions and processes to the energy sector that help to digitally transform the industry. These solutions and processes help the energy transformation, increase overall sector reliability and resiliency, and provide a benefit to the public.

Prior to joining EPRI, Mr. Hollern was an engineering supervisor for cyber security at AREVA Inc. He led a team focused on cyber security engineering solutions and services for more than half of the U.S. nuclear fleet, implemented parts of the North American Electric Reliability Corporation – Critical Infrastructure Protection (NERC CIP) compliance program, and worked with international power plants to implement cyber security processes and tools around the world.

Mr. Hollern previously worked with the U.S. Department of Homeland Security's Industrial Control System – Cyber Emergency Response Team (ICS-CERT) in incident response and vulnerability mitigation. He was also an engineer at the Idaho National Laboratory's (INL) Control Systems Security Program and in the Safeguards and Security Program.

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EPRI Resources

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DC Flex

Cyber Security for Generation Assets

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