Network Advisory: Creating a Comprehensive Dashboard

Part 1 of a 2-part Network Member Case Study on Data Center Cooling Efficiency Optimization

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Smarter Together

The Uptime Network is a community of data center owners and operators under mutual NDA. No member organizations or individuals are named in this report.

This is part one of a two-part case study showcasing data center cooling optimization from a member company.

Network advisory documents do not necessarily represent the opinions of Uptime's technical leadership or members but instead provide members resources to track our community's ongoing discussions. These readouts are intended for Uptime Network internal use.

Email suggestions for future topics to Matt Stansberry: mstansberry@uptimeinstitute.com.

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Topics of Discussion

- An effective dashboard can facilitate efficiency gains, sustainability and operational benefits.
- Including cross-functional inputs supports key objectives.
- Providing this sample dashboard can assist member organizations building their own systems.

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About this case study

- An Uptime Network Member offered to share details of its measurement-based approach to quantifying cooling system inputs and performance.
- The initiative was driven by the need to address public sustainability commitments. The firm committed to a strategy of reducing emissions by optimizing data center cooling systems.
- A cross-functional (IT and facilities) team was established. The team settled on the use of *cooling efficiency ratio* (CER) to monitor and improve cooling system performance.
- The team identified existing measurement points and installed new sensors and meters to enable real-time reporting of CER (and other critical operational metrics).
- This report explores the creation of the holistic dashboard that delivers a high-resolution view of power and operational metrics for cooling, electrical, and IT infrastructure systems. A companion document provides a deep dive into CER itself.

The case organization’s strategy hinged on its ability to ‘connect the dots’ across multiple IT and facility factors. Key data inputs included:

- Power usage information from utilities, IT infrastructure, and building systems.
- Water usage information from utilities and (where applicable) well systems.
- Cooling information from chillers, computer room air handlers (CRAH), towers and pumps.
- Carbon impact calculated from power usage and grid factors.
- IT equipment information reflecting device category, age and manufacturer.
- Maintenance information from ticketing systems.
- Facilities event information from facility logs.

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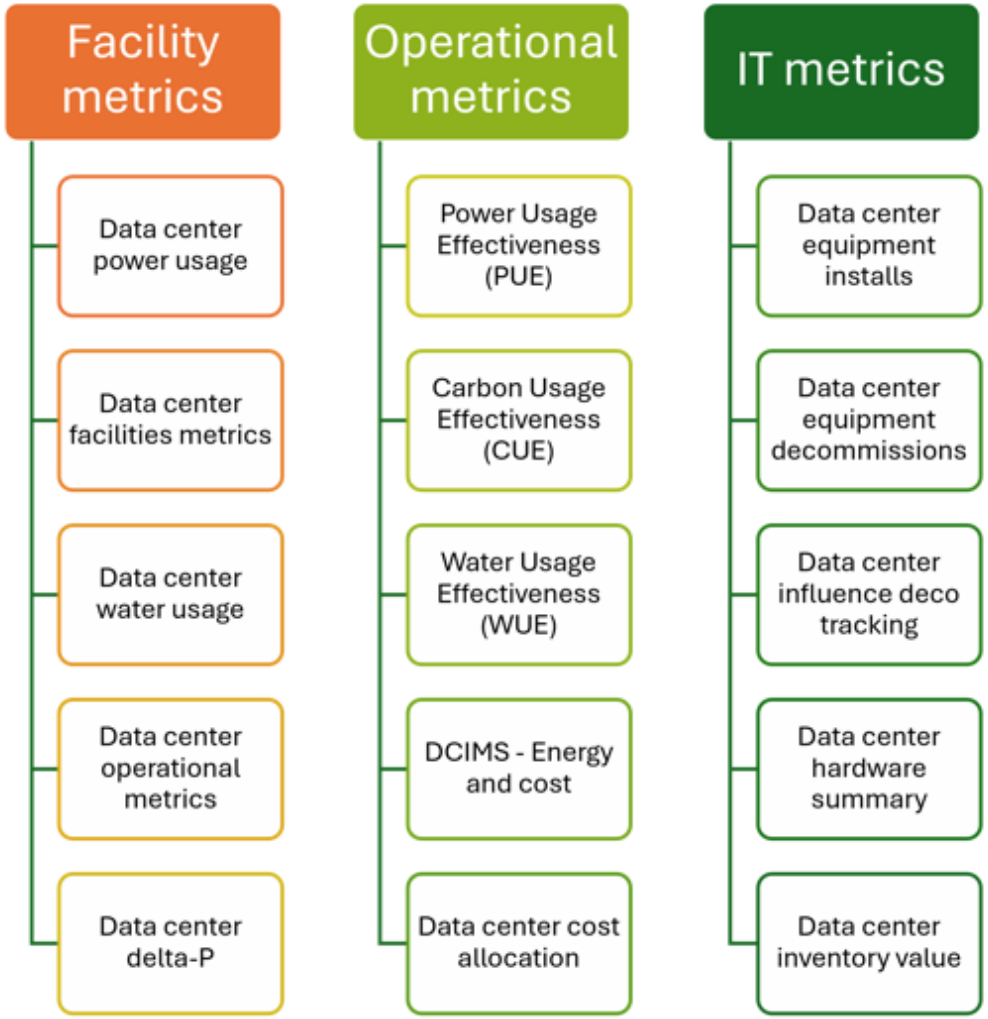
The case organization developed a suite of dashboards to create a holistic perspective for real-time tracking of operational and sustainability metrics.

These dashboards included:

- Facility metrics
- Operational metrics
- IT infrastructure metrics



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Facility Metrics

Data Center Power Usage:

- Total power used and cost within the data center (utility meter).
- IT power – measured from UPS.

Enables seasonal trend analysis of facility.

Thermal Metrics:

- DCIM thermal metrics for all rack and individual servers in the data hall
- Monitors server sensors for device inlet, exhaust and CPU temperatures

Data is used to avoid hot spots or over-cooling. Future support planned for delta-T (temperature) analysis.

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Data Center Power Usage

DC1 | DC2

Month: All

Year: 2024

Average Monthly Power Cost	Sum of Power Cost	Average of Cost per kWh	Average Monthly Power Usage kWh	Sum of Power Usage kWH
$198K	$1.98M	$0.08	2.35M	23M

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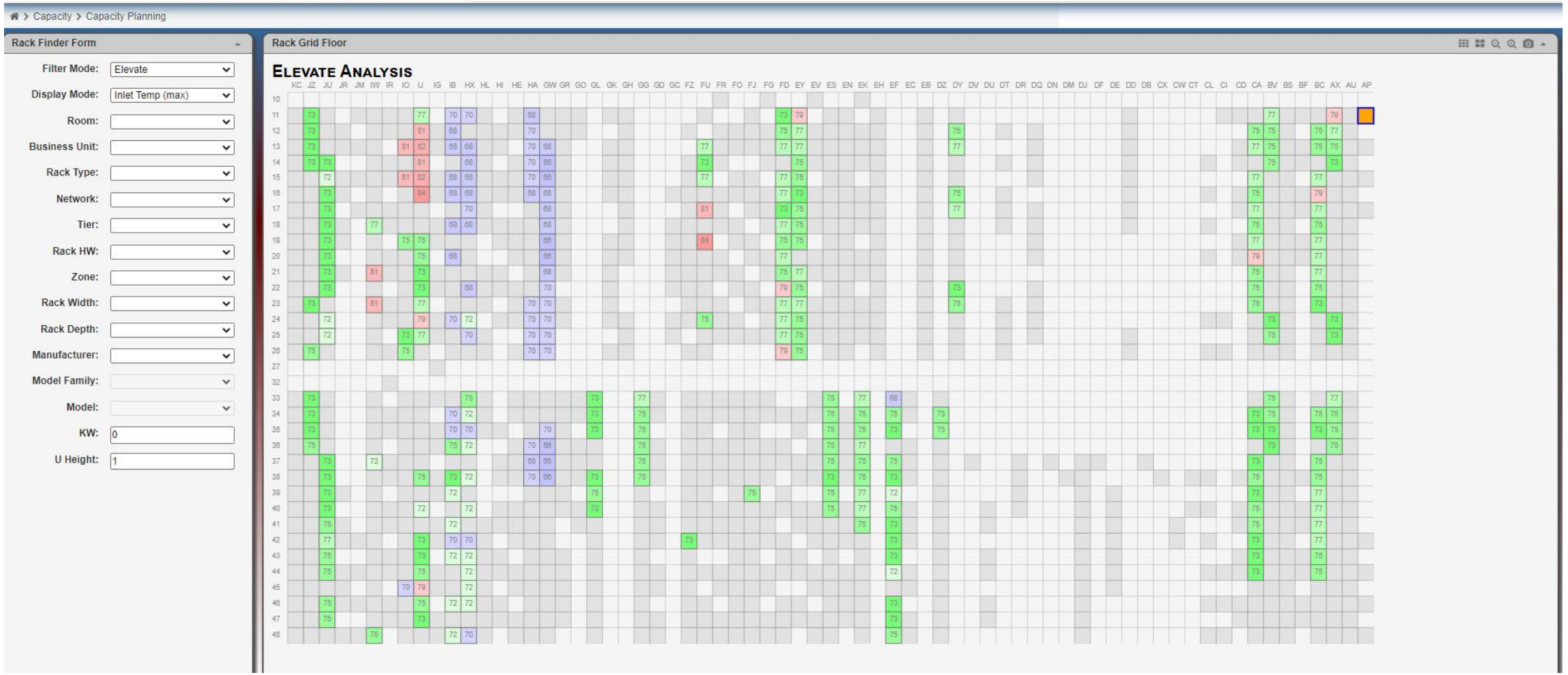
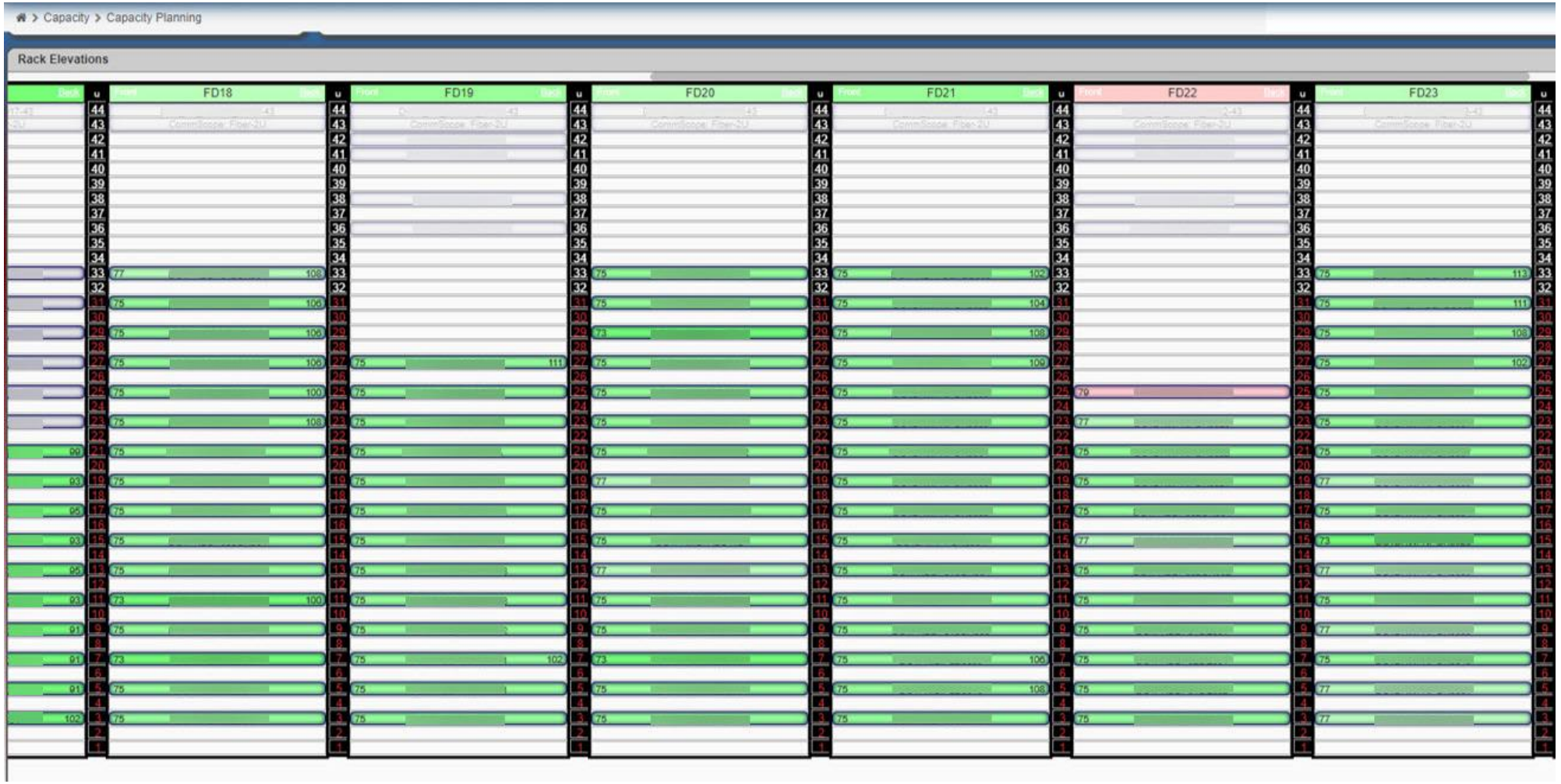
Server Inlet Temps Mapped Across Raised Floor



Server Inlet Temp by Rack Elevation



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Facility metrics

Data Center Water Usage:

- Total water used from utility-sources and well water.
- Cost of water

Delta-Power through Time:

- Real time IT UPS power demands, identifying daily and monthly changes

Tracks benefits of removal of old, under-utilized equipment and refresh and consolidate projects. Addresses health and efficiency of IT infrastructure.

Data Center Operational Data

- Facility maintenance orders
- Mean time to repair tracking

Facilitates pro-active maintenance strategies.

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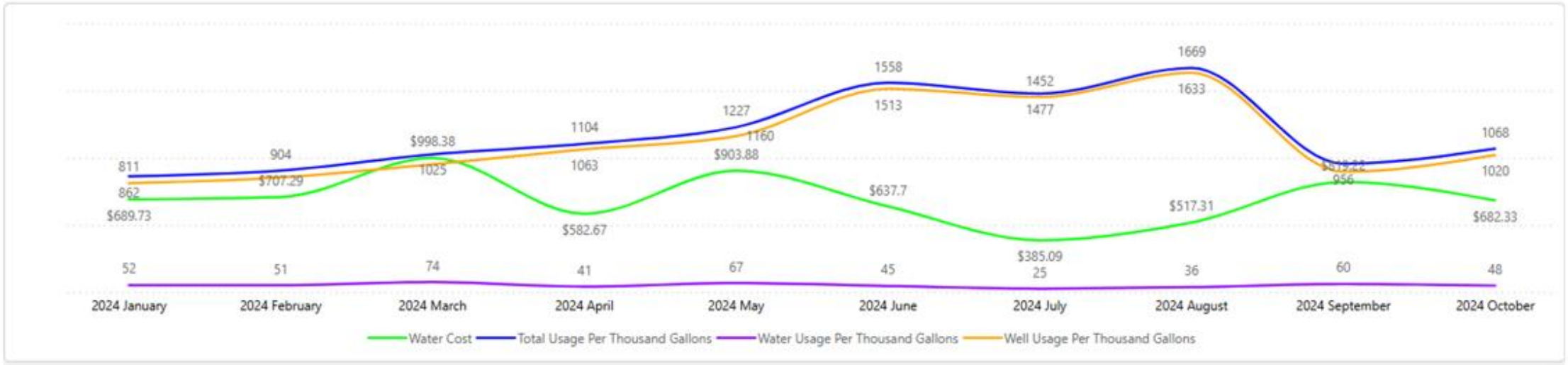
Data Center Water Use



DC1 DC2

Month
All

Year
2024

AverageMonthly Water Cost
$692.36

Average Monthly Water Usage per Thousand Gallons
49.88

Average Monthly Cost per Thousand Gallons
$14.02

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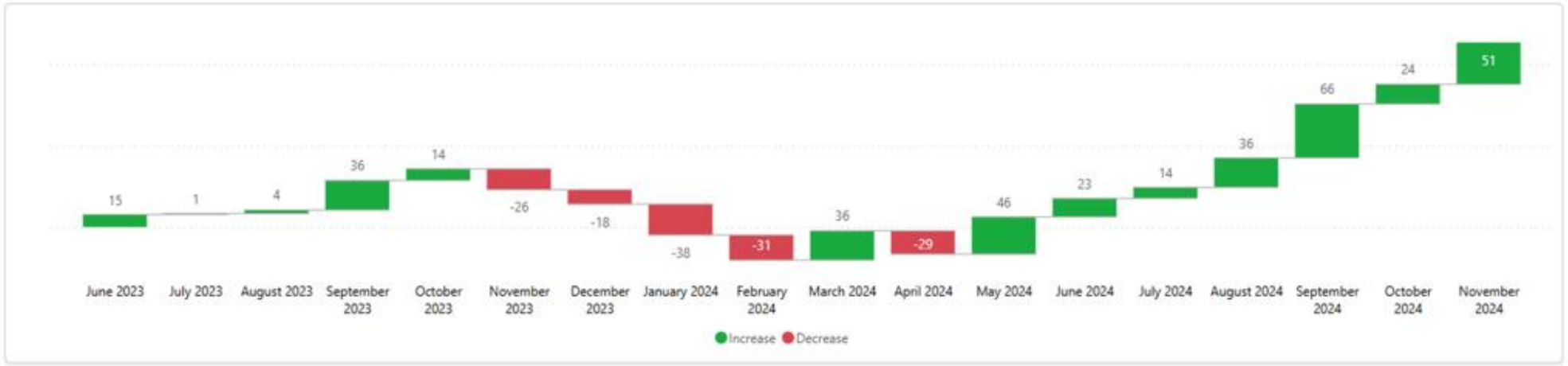
DC Delta Power – UPS Power Capacity Increase/Decrease



DC1 | DC2

Date

6/1/2023 — 11/30/2024

Year Month	Starting KW _d	Ending_KW_relation	KW change_d
November 2024	0.54	51.88	51.34
October 2024	3.06	27.35	24.28
September 2024	0.85	67.28	66.42
August 2024	4.84	41.12	36.28
July 2024	7.85	21.39	13.53
June 2024	40.42	63.19	22.78
Total	**412.39**	**639.32**	**226.93**

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Operational Metrics

Power usage effectiveness (PUE):

- Total data center power usage divided by power delivered to IT equipment.
- Tracks balance of IT power demand and cooling demand

Continuously analyzes UPS capacity utilization, building load, and IT load (all in kW) and integrates contextual information on facility events,

Carbon Usage Effectiveness (CUE):

- Total carbon emissions attributable to data center energy consumption divided by the IT equipment energy consumption.

Accounts for the carbon intensity of different electric grids and emissions from backup generators.

Best used to compare different data center locations and year to year reductions in carbon emissions at individual locations.

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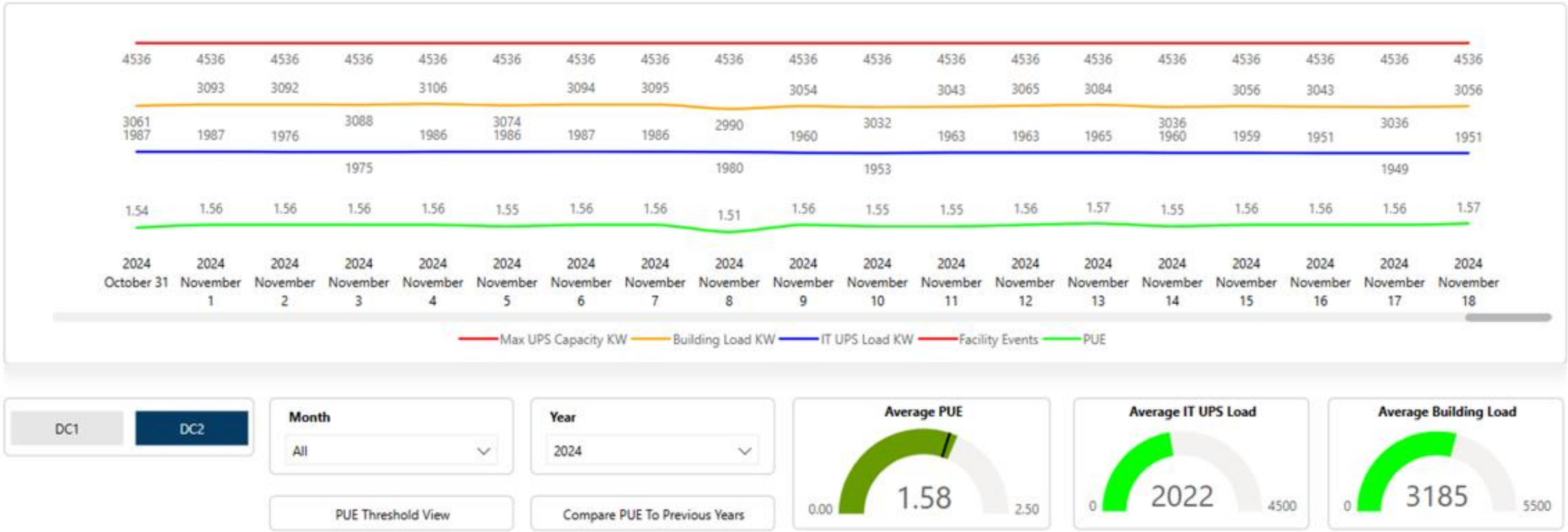
Power Usage Effectiveness (PUE)



DC1 | DC2

Month: All

Year: 2024

PUE Threshold View

Compare PUE To Previous Years

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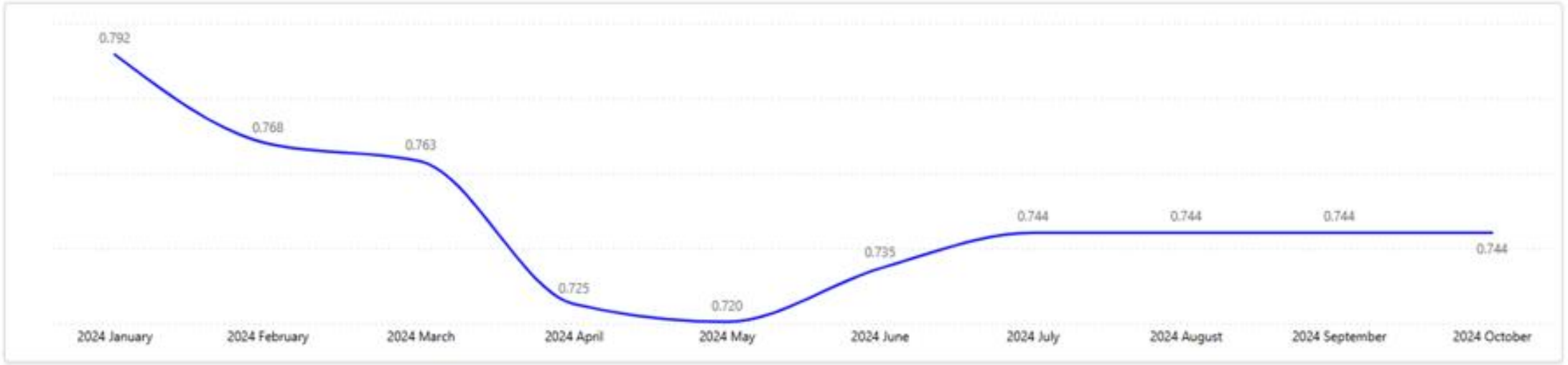
Carbon Usage Effectiveness (CUE)



DC1 | DC2

Month
All

Year
2024

CUE Threshold View

Average CUE

Carbon Usage Effectiveness (CUE) is a performance measurement that helps determine the amount of greenhouse gas (GHG) emissions produced per unit of IT energy consumed within a data center. It provides an effective way to measure the carbon footprint and thus the environmental impact of data center operations. CUE was introduced by The Green Grid dedicated to advancing energy efficiency in data centers and business computing ecosystems. This measurement complements the Power Usage Effectiveness (PUE) metric, another Green Grid creation that indicates the energy efficiency of a data center.

The formula is as follows using Emission factor of .373 for DC1 & .474 for DC2
CUE = Total CO2 emissions (kg) / Total IT Energy (kWh)
This ratio gives a clear view of the carbon emissions associated with the IT load of a data center.

Average Monthly CO2 emissions (kg)

1.11M

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Operational Metrics

Water Usage Effectiveness (WUE):

- Total facility water consumption (liters/year) divided by energy used by IT equipment (the denominator in the PUE equation).

WUE compliments PUE by accounting for water used by the cooling system: energy efficiency is improved at the cost of higher water use.

DCIM base energy & cost tracking

- DCIM data to assess energy consumption, efficiency, and energy costs of distinct IT infrastructure subsystems.

Enables assessment of the financial and carbon benefits of energy and water efficiency projects

Filters are used to assess IT systems by age, device counts, power demand, and IT capacity to target candidates for refresh and consolidation.

Enables chargeback for IT services including x86 compute, network, storage, and mainframe.

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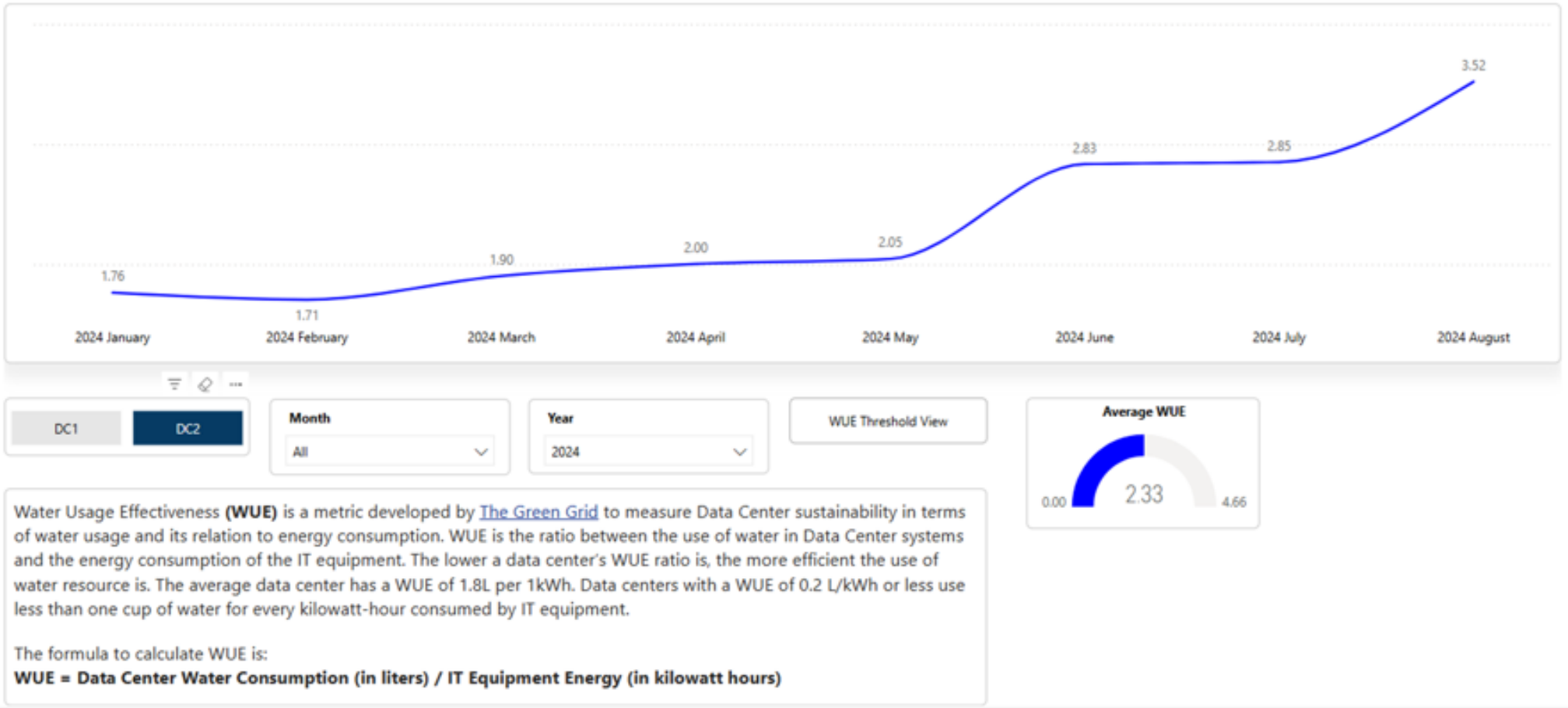
Water Usage Effectiveness



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DCIM Devices/kWh/Cost/Carbon

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IT Metrics

Data Center Installs:

- A count of newly installed devices by category and their power consumption.

Data Center Decommissions:

- Tracks status and removal of older (seven plus years), underutilized IT devices

Extended views track energy use reductions and cost savings gained through retirement of the end-of-life equipment.

Tracking this data enables correlation changes in energy use, PUE, WUE, CER, and CUE with changes in the IT device inventory

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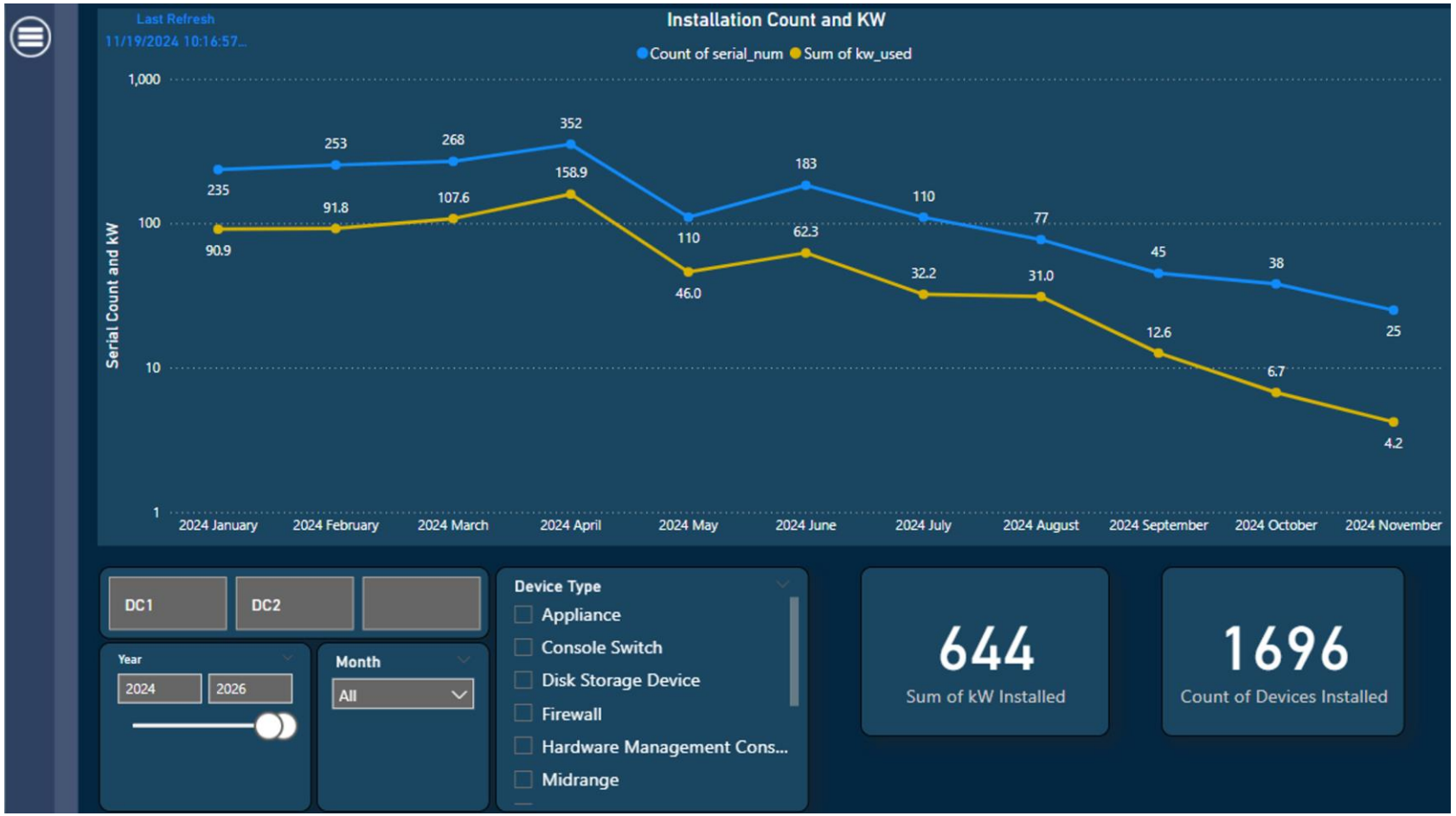
Data Center Installs



Data Center Decommissions

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IT Metrics

Targeted Decommissioning:

- Tracks the improvements in energy and sustainability performance driven by decommissioning and/or refresh of older IT equipment, above and beyond the typical refresh cycles that occur naturally over time, focusing on the devices that have lost oversight from IT teams.

Hardware Utilization Summary:

- Device counts, energy use, and equipment utilization are monitored to continuously assess the ‘health’ of the IT system.
- The data can be filtered by facility, age, and manufacturer.

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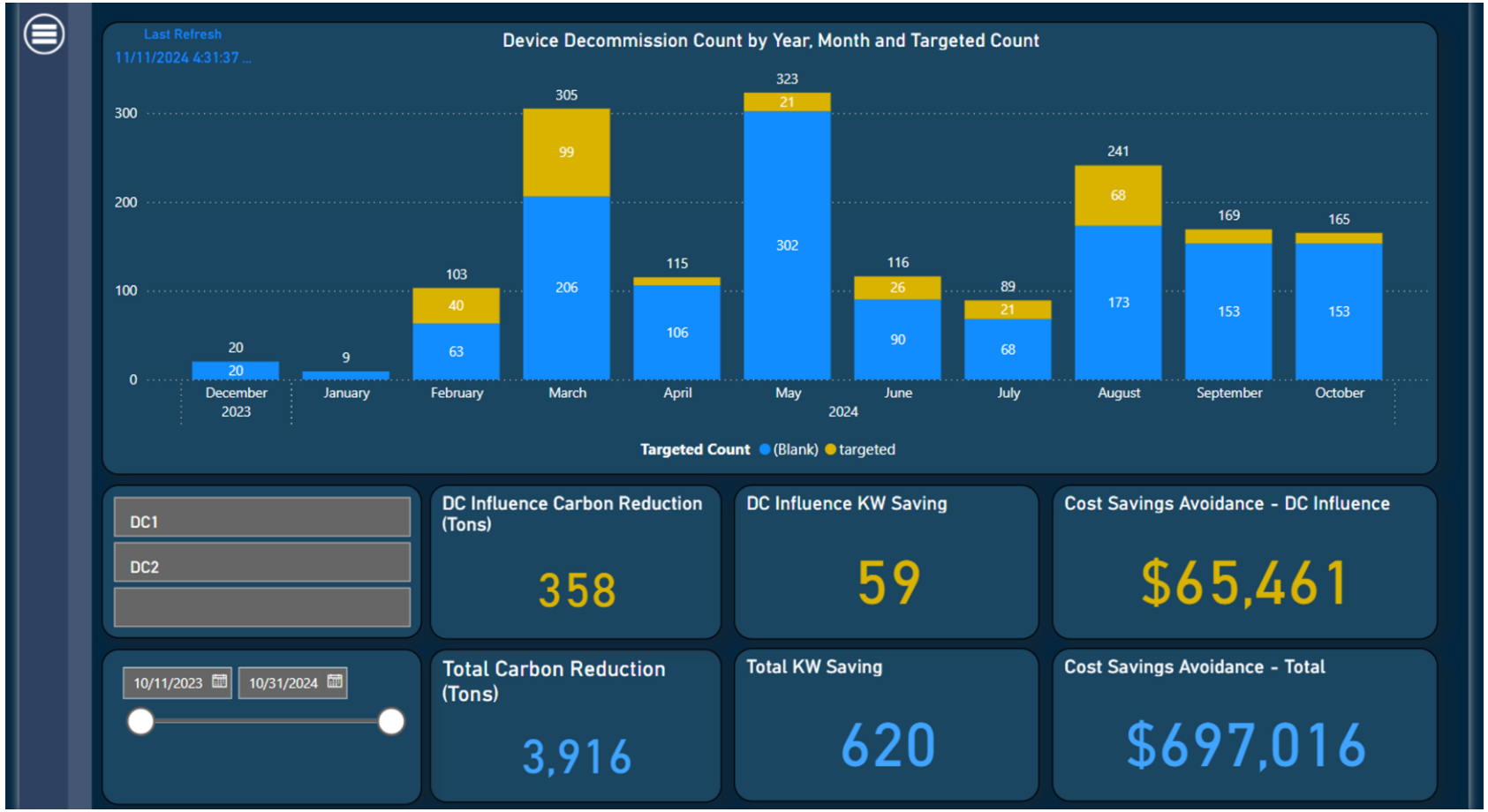
Targeted Decommissioning Impact



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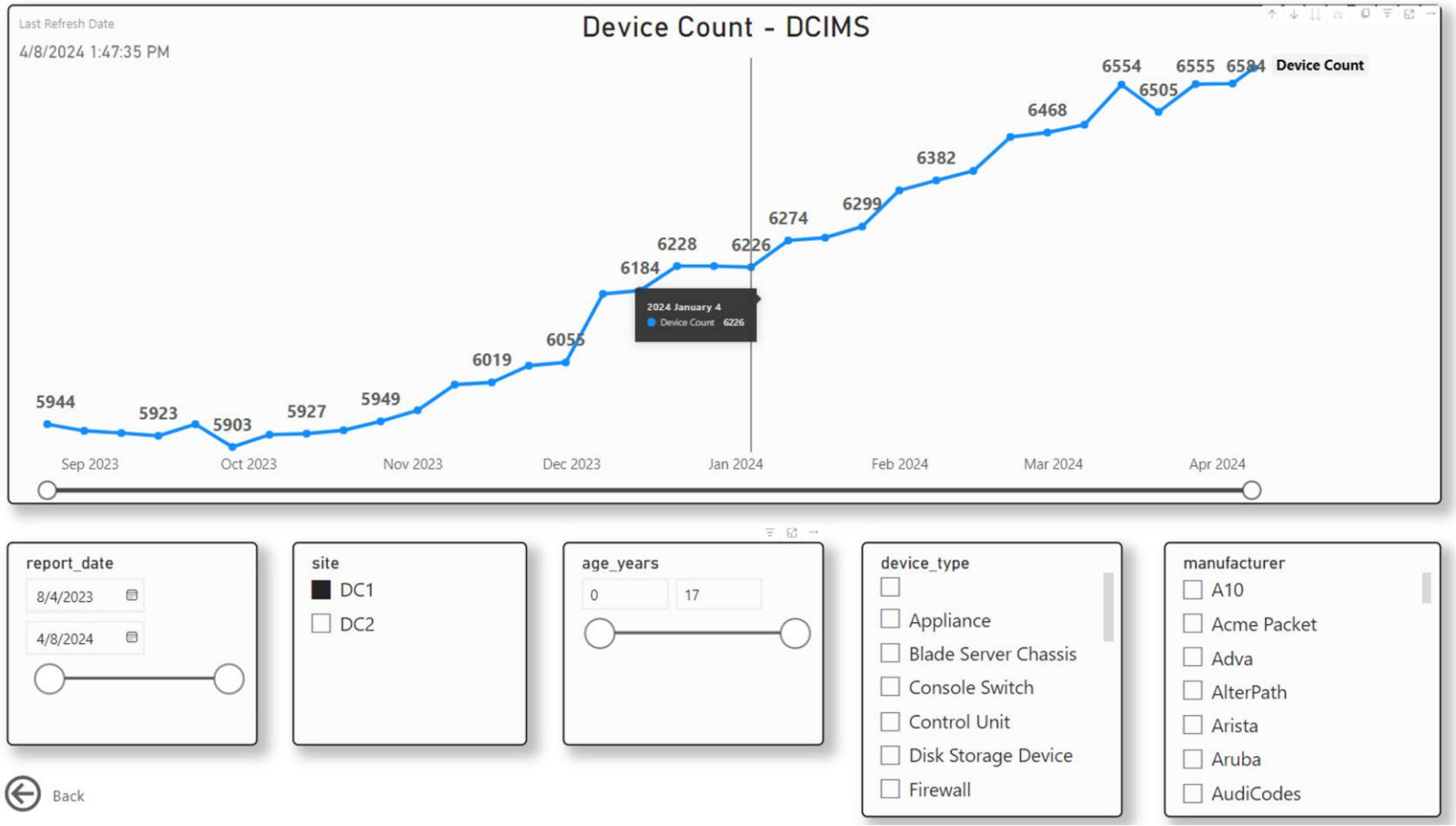
Hardware Summary and Utilization



Key Observations

- Integrating facility and IT metrics provides a powerful, unified view of efficiency.
- IT efficiency is a critical part of overall data center performance.
- Creating a joint IT/facilities team with shared goals and metrics improves outcomes—the whole is greater than the sum of its parts. The team meets bi-weekly.
- Dashboards like this require commitment: both to the system's build and upkeep, and to acting on the insights it generates.
- The initiative required minimal new investment—existing meters, sensors, and data feeds provided the needed inputs.
- Real-time dashboard analysis drives improvements in both business and sustainability performance.
- These systems require thoughtful, sustained effort—but deliver fact-based insights that validate or challenge assumptions in data center operations.

About this document: This Case Study report was prompted by an interaction with an Uptime Network member in the second half of 2024. Contributing Uptime experts included Jay Dietrich.

Please contact Scott Killian at skillian@uptimeinstitute.com or Matt Stansberry at mstansberry@uptimeinstitute.com if you would like to schedule a discussion with an Uptime expert on building a cooling efficiency dashboard system or related topics.

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