MEETING DATA CENTER DEMAND WITH LOW-CARBON POWER

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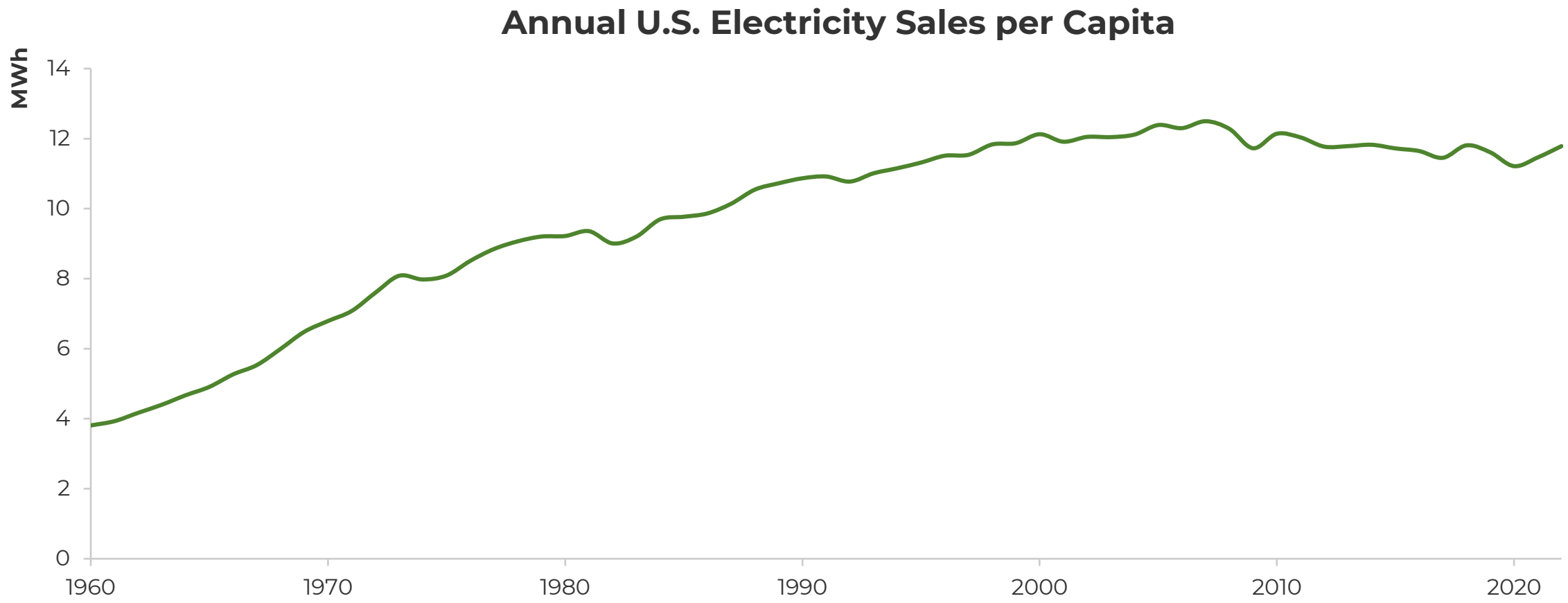
Analyst

ELECTRICITY BOOM?

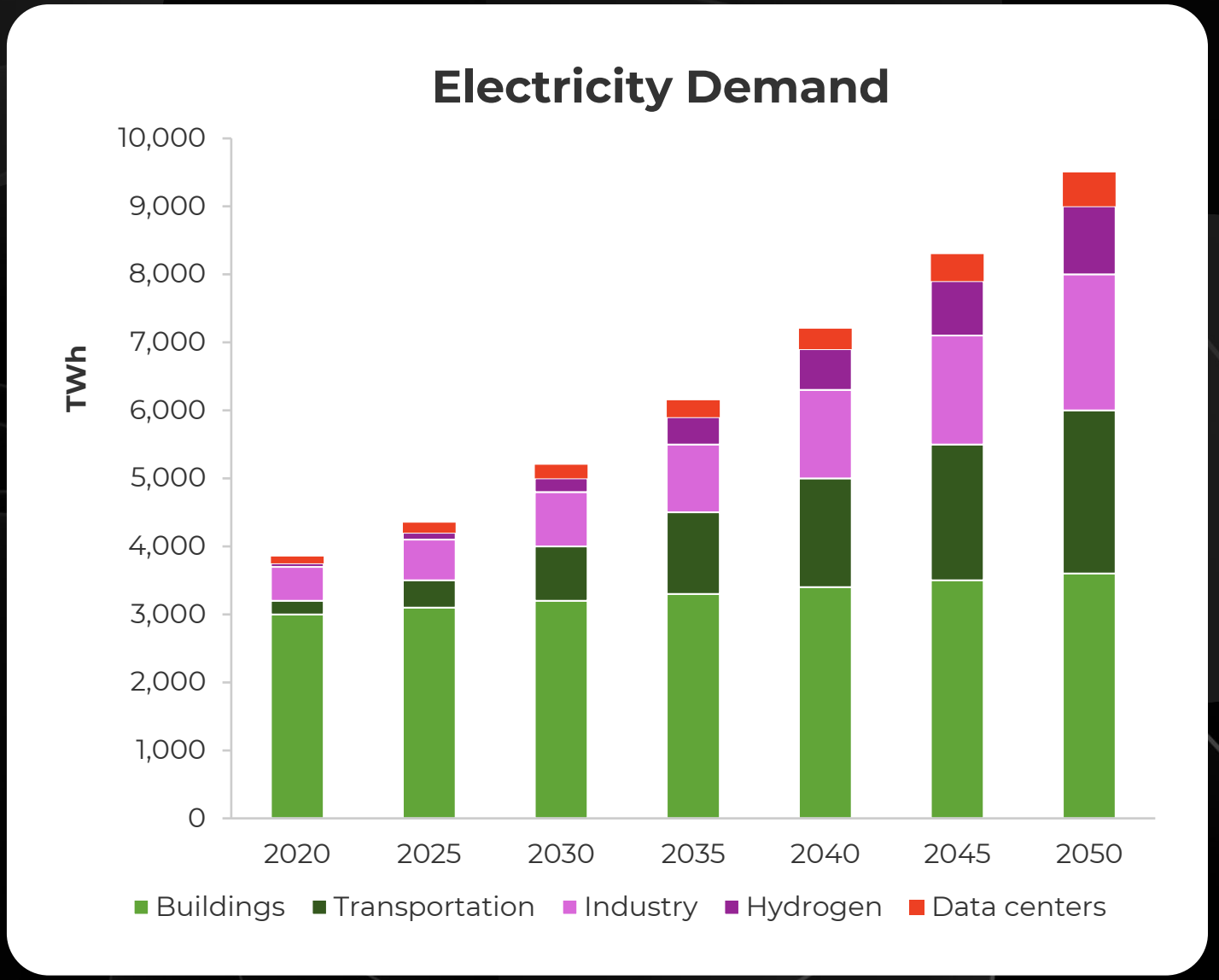


Source: U.S. Energy Information Administration (EIA)

Image source: Choice

SKYROCKETING ELECTRICITY DEMAND

Demand growth is uncertain but undeniable.



Source: EPRI

Global electricity demand increased by 4.3% in 2024, a step change from the 2.5% growth seen in 2023. The average pace of electricity demand growth from 2010 to 2023 was 2.7%.

Global Energy Review 2025

Image source: International Energy Agency

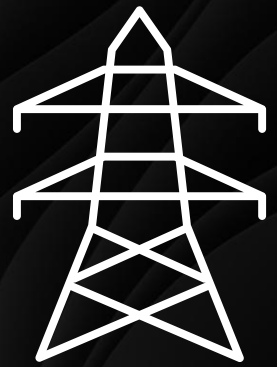
WHAT TO EXPECT

01 **You'll understand the scope of issues utilities must address in a changing grid landscape.**

02 You'll see how to build a strategy for meeting rising electricity needs while maintaining reliability.

03 Lux charts long-term electrification pathways that incorporate low-carbon power.

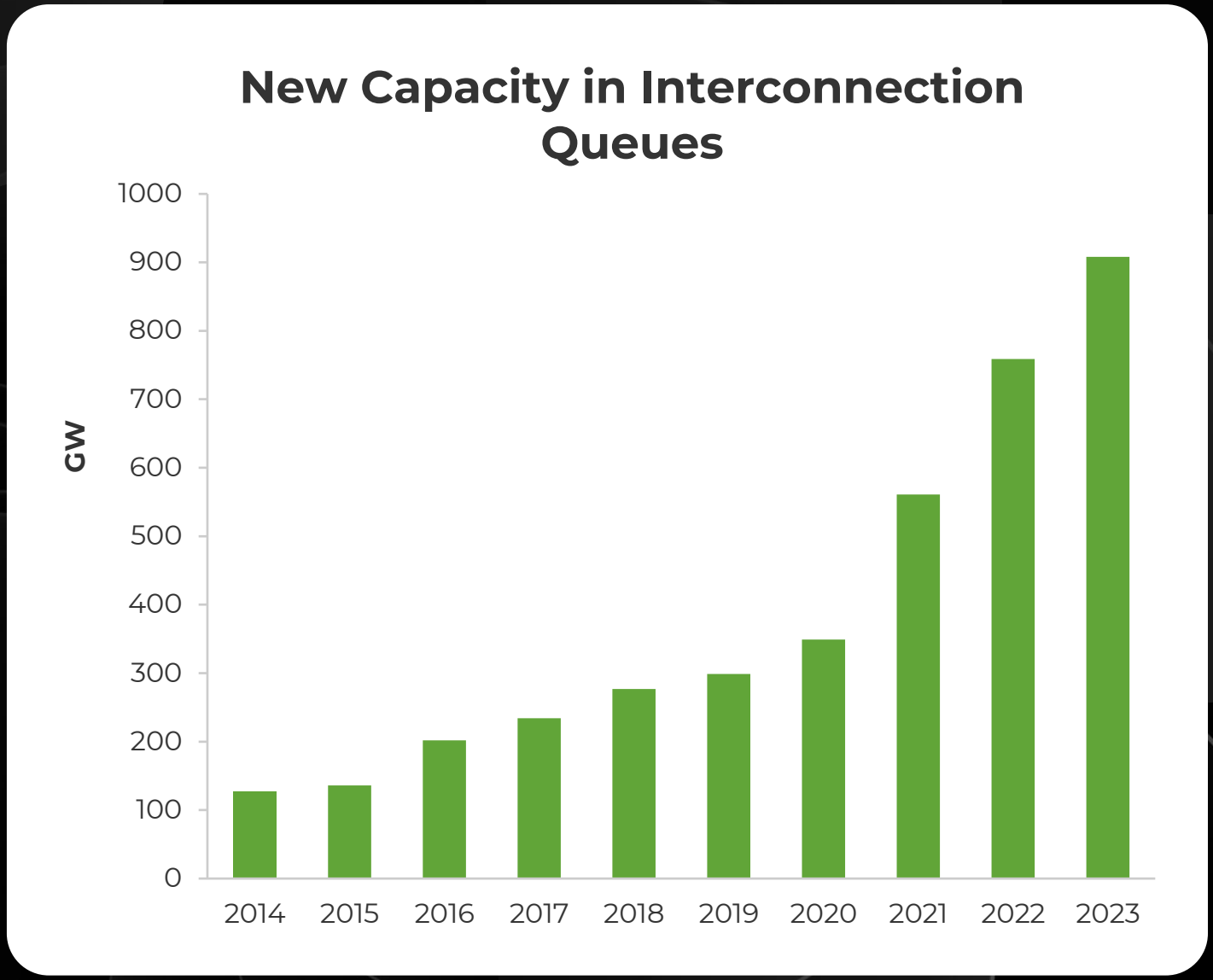
UTILITIES JUGGLE EVOLVING GRID NEEDS



Infrastructure management

UNLOCKING NEW CAPACITY

Interconnection queues limit grid expansion to meet growing electricity demand.



Source: Berkeley Lab

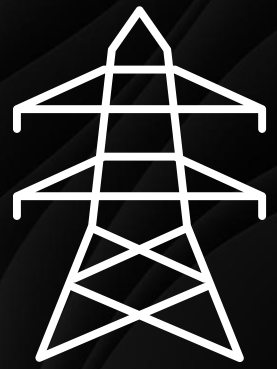
“ ”

Getting this done by the July 2025 time frame is too large an effort for us and our participating transmission owners

CAISO in reference to FERC order requiring upgrade of grid infrastructure

Image source: Galooli

UTILITIES JUGGLE EVOLVING GRID NEEDS



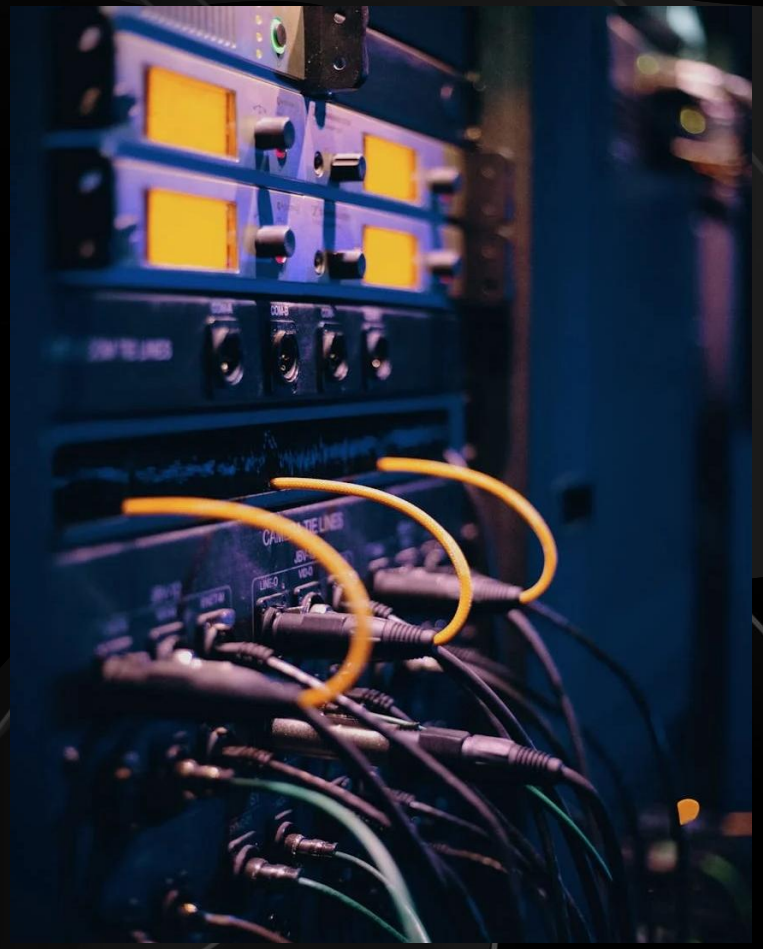
Infrastructure management

New electricity loads

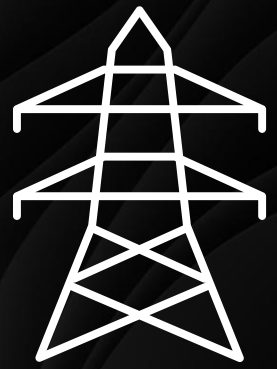
MCS (10 MW)

EAF (18 MW)

DATA CENTERS (250 MW)



UTILITIES JUGGLE EVOLVING GRID NEEDS

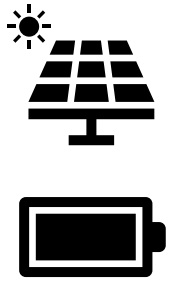


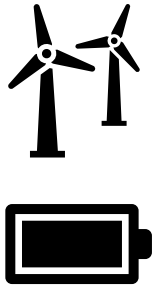
Infrastructure management

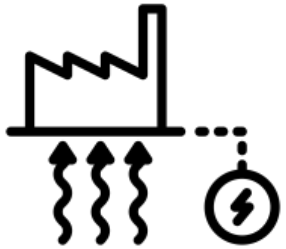
New electricity loads

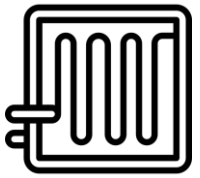
Decarbonization

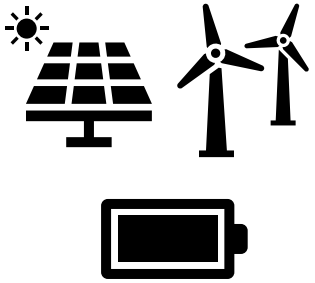
POWER-GENERATION OPTIONS

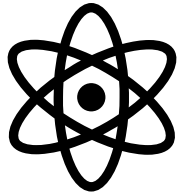












Setting up charging infrastructure needs to be a very involved process with the utilities. Even with all the construction behind the meter complete, the **final interconnection was challenging**. In some cases, when an upgrade to the grid was required, **it took up to a year**.

North American beverage company

Utilities and customers must collaborate on electrification strategies

WHAT TO EXPECT

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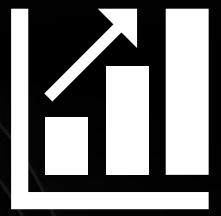
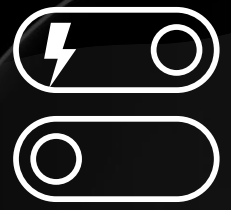
EVALUATE NEW LOADS WITH 3 ATTRIBUTES



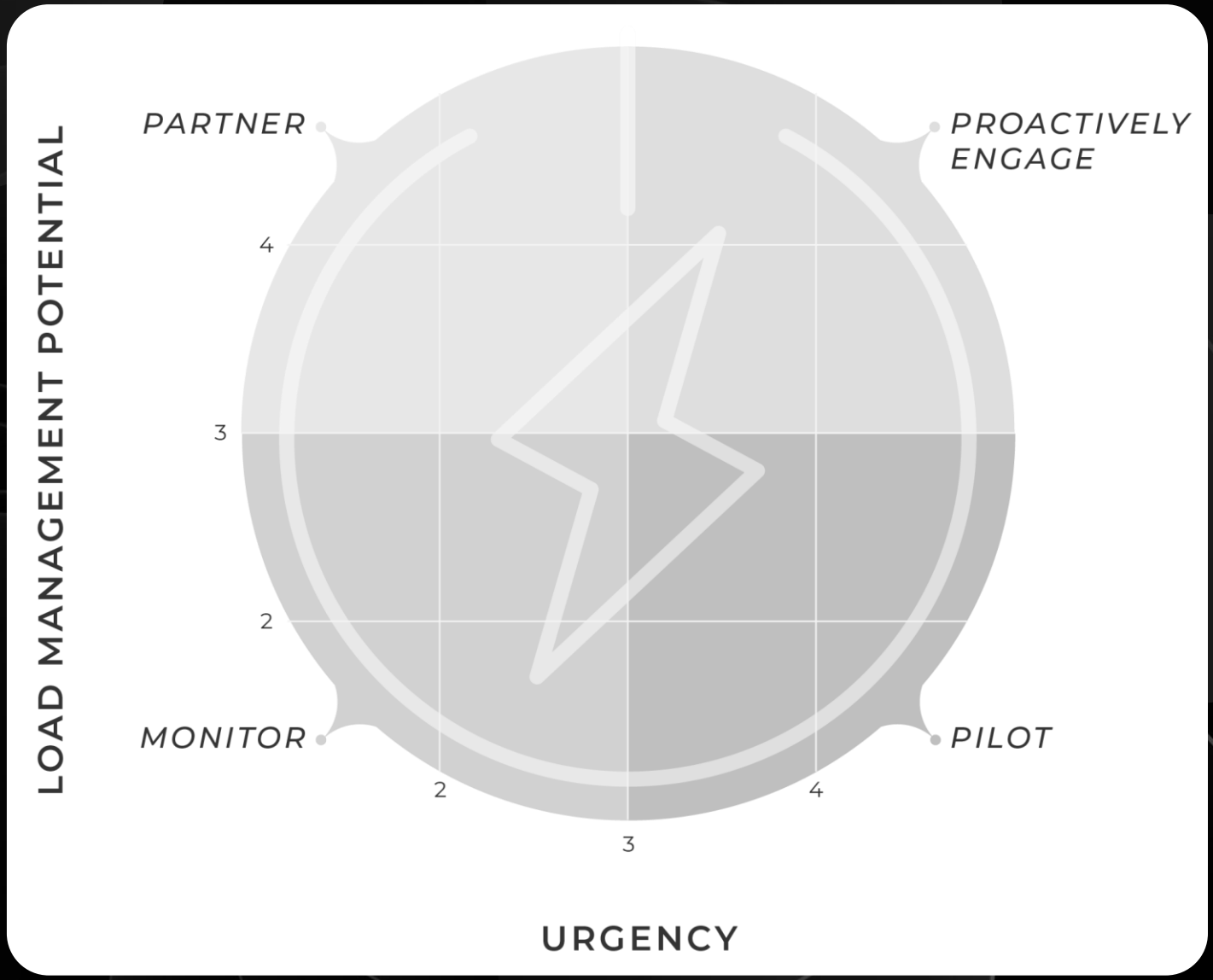
Magnitude of demand

Urgency

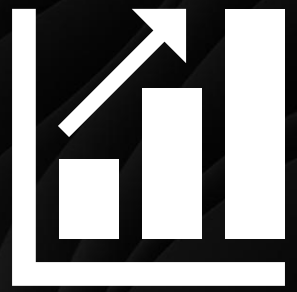


Load management potential

STRATEGIES FOR LOAD GROWTH



DATA CENTERS



Magnitude of demand

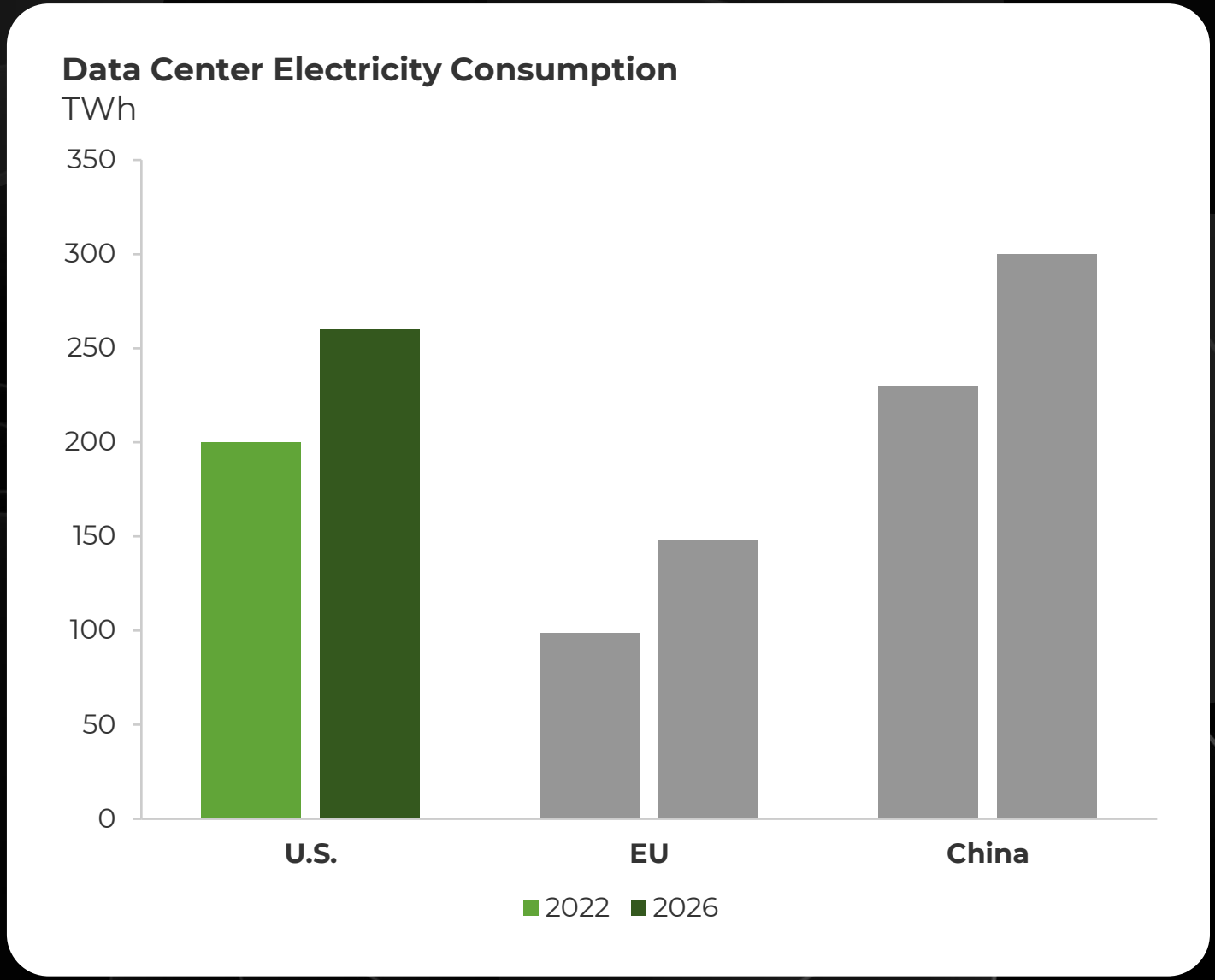
250 MW

Urgency

High

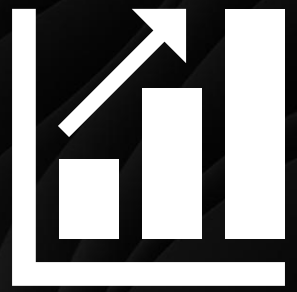
NEED MORE ELECTRICITY

Data center electricity demand in the U.S. is expected to reach 260 TWh in 2026.



Source: IEA

DATA CENTERS



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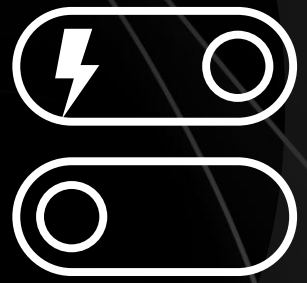


Load management potential

Moderate

“ ”

....adding new capabilities that allow us to temporarily reduce the power demand of a Google data center when called on to do so by an external power system partner.

Google

“ ”

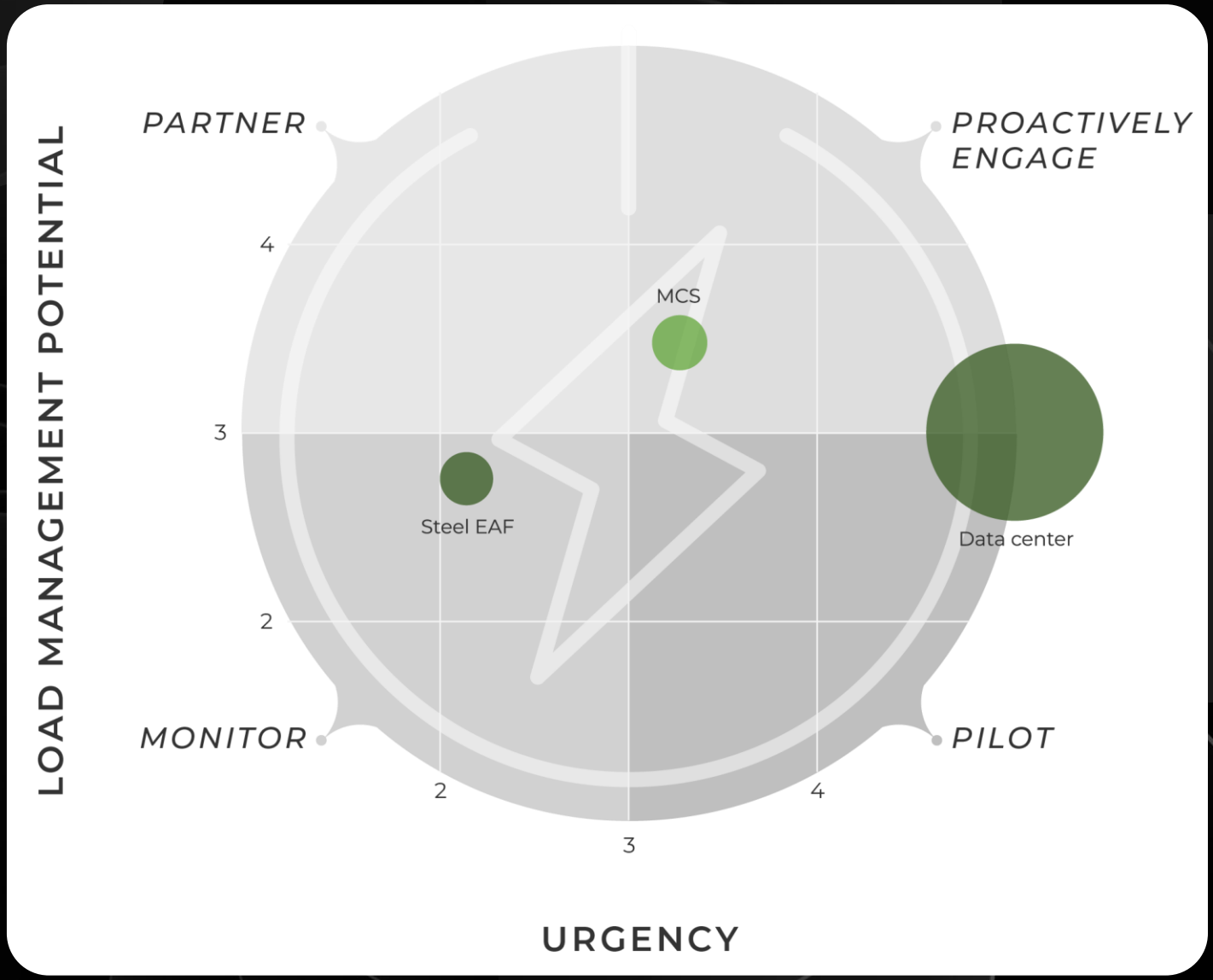
Do not believe everything you read about data center demand flexibility. Data centers are for-profit and not philanthropic.

North American data center developer

Source: Google

DATA CENTER

For the most urgent new load, utilities must find ways to incentivize flexibility or behind-the-meter power generation to handle large loads.



WHAT'S THE BEST PATH FORWARD TO POWER DATA CENTERS?

“ ”

Data centers often turn to natural gas since the gas grid is more stable than the electricity grid.

North American data center developer

“ ”

Developers go straight to gas if they are looking at on-site generation for data centers.

North American data center advisory firm

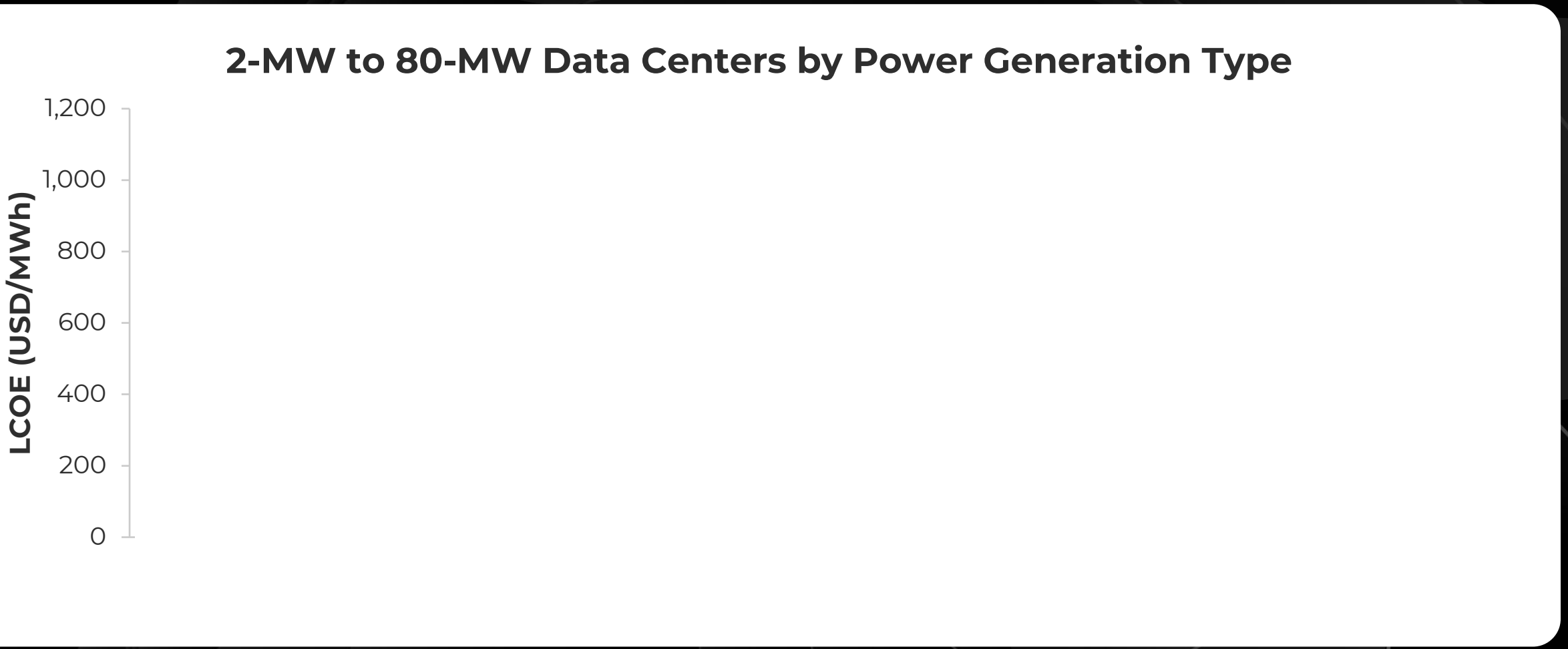
BIG PLAYERS ANNOUNCING GAS PLANS

Oil majors like ExxonMobil and Chevron target natural gas power for data centers as a new business avenue.

VoltaGrid and Vantage partner for 1 GW of gas power for data centers.

Image source: ExxonMobil, VoltaGrid

ECONOMICS OF POWER: VIRGINIA



HYPERSCALERS EXPLORE GEOTHERMAL AND NUCLEAR

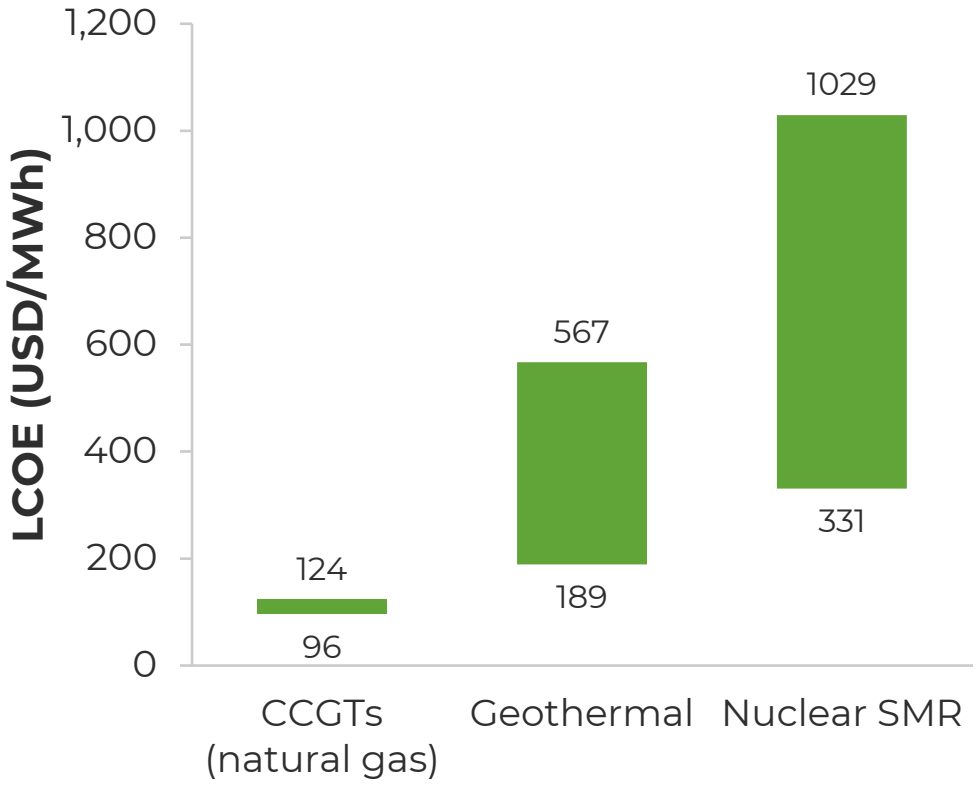
Sage Geosystems to provide 150 MW of geothermal power to Meta's data centers.

Google signs a PPA with Kairos Power to deploy SMRs for data centers.

Image sources left to right: Meta, Kairos Power

ECONOMICS OF POWER: VIRGINIA

2-MW to 80-MW Data Centers by Power Generation Type



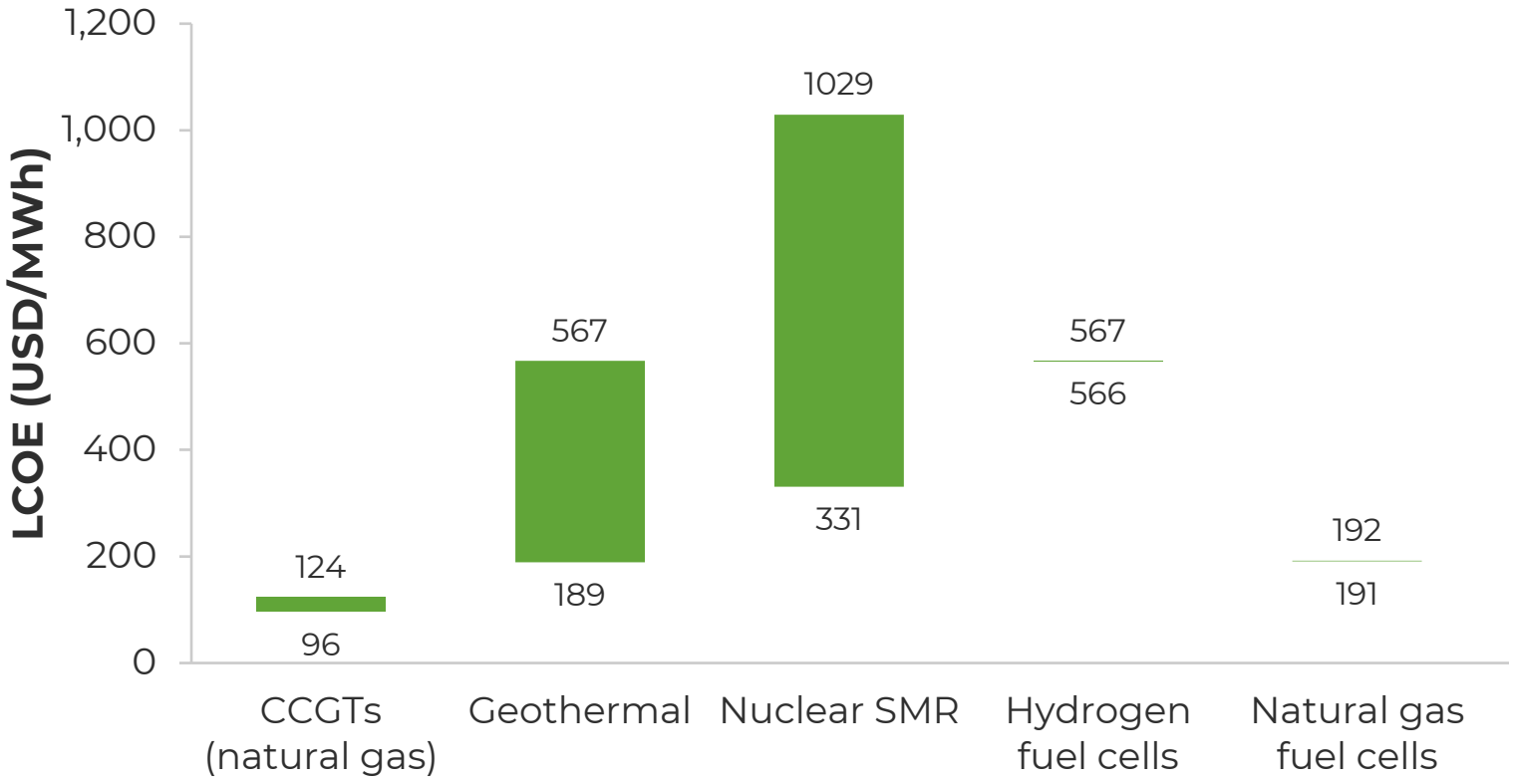
FUEL CELLS MOSTLY PROVIDE BACKUP

Microsoft tested a 250-kW fuel cell system to power a row of data centers for 48 hours back in 2021.

Microsoft partners with ESB for a fuel cell pilot at its Dublin campus.

ECONOMICS OF POWER: VIRGINIA

2-MW to 80-MW Data Centers by Power Generation Type



SOLAR AND WIND PPAS ARE POPULAR

Meta signs 200-MW solar PPA with RWE in Texas.

Google signs PPA for 79.3 MW of onshore wind power in Virginia.

Image sources, left to right: RWE, Apex Clean Energy

DATA CENTER DOWNTIME IS COSTLY

63%

of outages resulted in **>USD 100,000 in losses**

>USD 1 million

in losses in **15% of outages**

43%

data center outages were caused by power-related problem

Source: Hitachi Energy

MICROGRIDS ARE EMERGING

Tencent builds solar and storage microgrid in Tianjin.

Google signs partnership with Intersect Power and TPG Rise Climate to co-locate data centers and renewables.

Image source: Tencent, Intersect Power

FLEXIBILITY IS HIGH ON THE AGENDA

California ISO

COMPASS datacenters

MISO

ercot

Meta

pjm

NVIDIA

DUKE ENERGY

Constellation.

Google

Life Is On Schneider Electric

nrg

WHAT TO EXPECT

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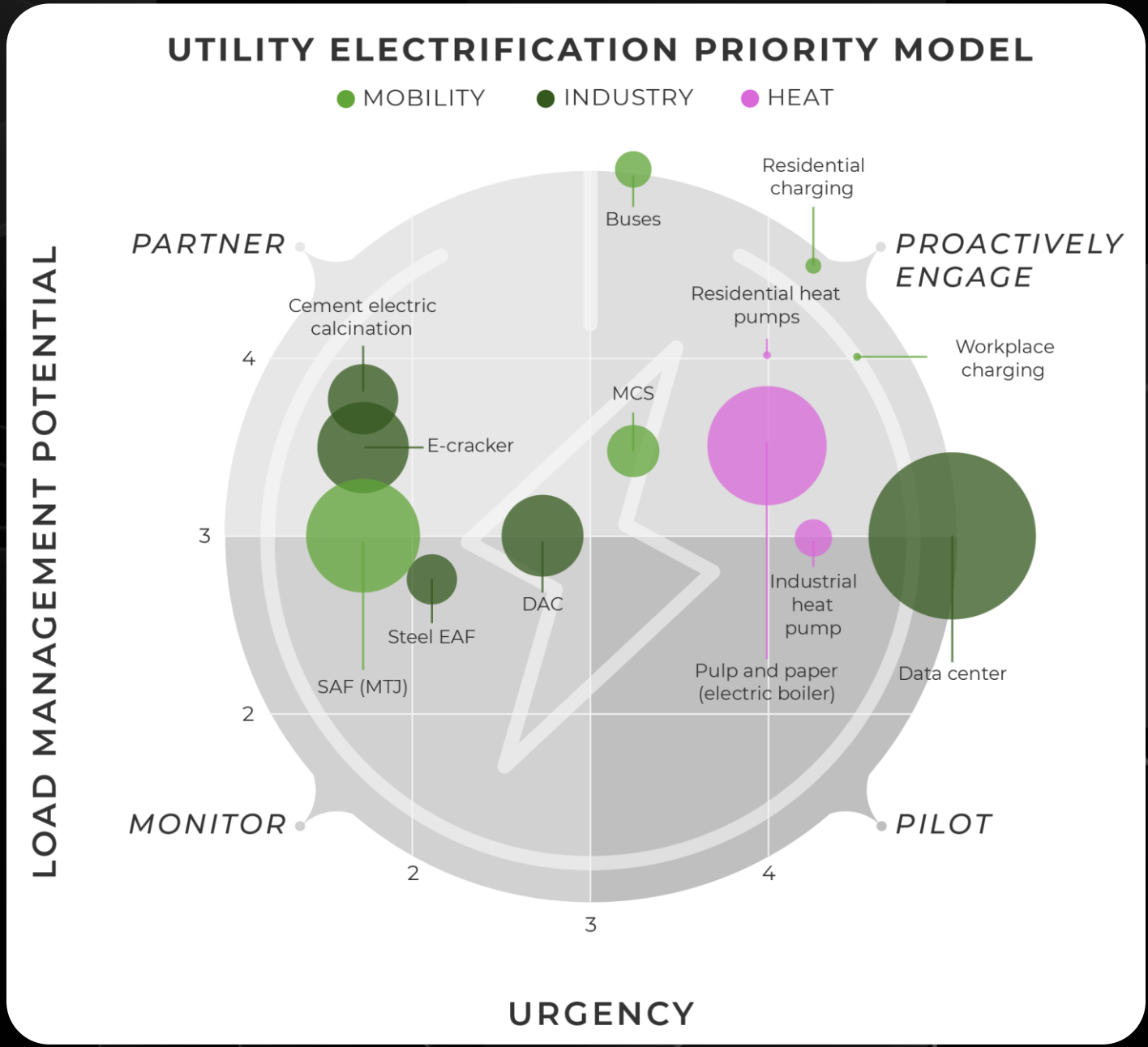
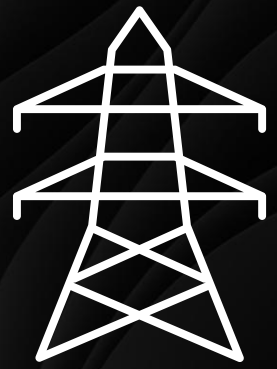
EXPECT NET NEW LOAD GROWTH



SOLVING UTILITIES' GRID NEEDS

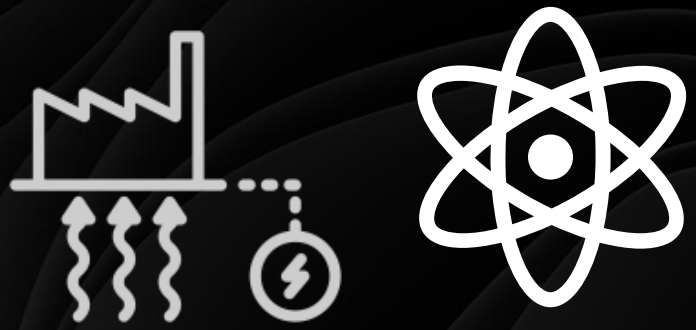


Infrastructure management

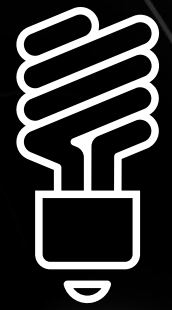
New electricity loads

Decarbonization

SOLVING UTILITIES' GRID NEEDS



Explore dispatchable power options



Monitor demand-side innovation

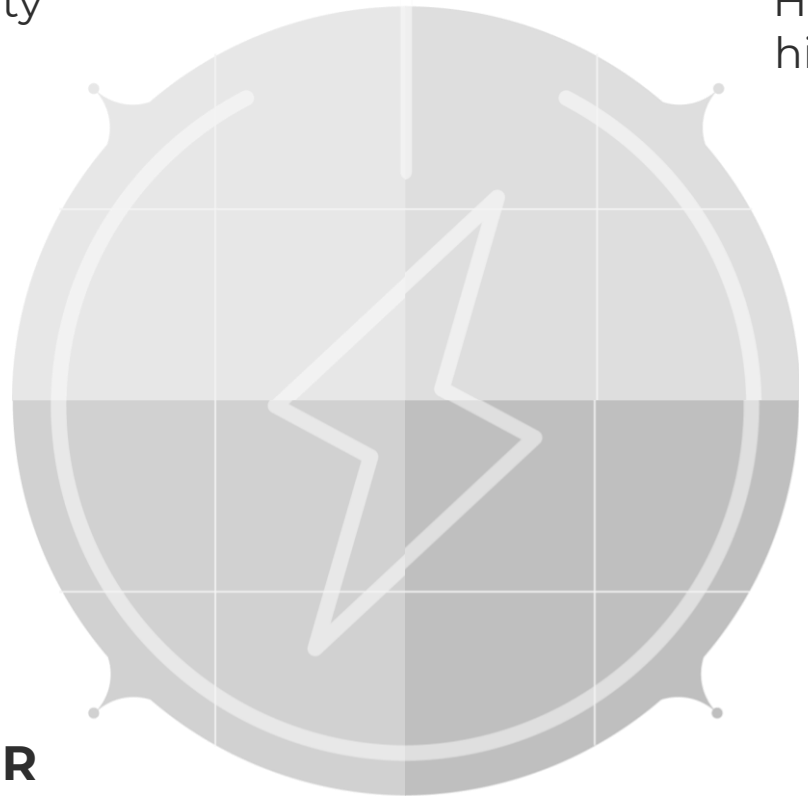
ELECTRIFICATION ROUTES DETERMINE STRATEGY

PARTNER

Low urgency, high flexibility

PROACTIVELY ENGAGE

High urgency, high flexibility



MONITOR

Low urgency, low flexibility

PILOT

High urgency, low flexibility

KEY TAKEAWAYS

1

Net new demand is rapidly growing.

Efficiency gains won't compensate for all this growth. Demand is expected to increase over 30% in the next 35 years.

2

Utilities need a strategy to anticipate customers' needs.

Electrification will be nonuniform across sectors, with each new load requiring a different strategy from utilities.

3

Behind the meter generation will increase.

The mismatch between power growth and grid interconnection timelines forces operators to explore on-site power generation options.

THANK YOU

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