How AI is Impacting Infrastructure

Realities, Opportunities, and Risks for Cities and Towns from the AI Revolution



AI: Fastest Technology Adoption...Ever

HOW LONG IT TOOK TOP APPS TO HIT 100M MONTHLY USERS

ChatGPT is estimated to have hit 100M users in January, 2 months after it's launch. Here's how long it took other top apps to reach that:



AI Already Changing Infrastructure

NATIONAL

Three Mile Island nuclear plant will reopen to power Microsoft data centers

SEPTEMBER 20, 2024 · 1:40 PM ET

By C Mandler



The Three Mile Island nuclear plant is seen in March 2011 in Middletown, Pa. Jeff Fusco/Getty Images

Your Tour Guide Today







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What We Will Talk About Today



A Quick Tour of the AI Future

- How We Got to this Al Moment
- How AI Impacts Infrastructure
- Infrastructure Opportunities



How We Did Get Here?

When I realize ChatGPT can do my job for me

When I realize ChatGPT can do my job for me



Accelerating Technology Change



The Four Factors Driving Al









- Cheaper and cheaper computing
- Ubiquitous fast connectivity
- Cheaper, better sensors
- Huge volumes of high quality data

Computing Getting Cheaper



Everyone's Connected



Plunging Sensor Costs

Example: Prices of Accelerometers, a key sensor used to detect motion and speed.



Volume of Data Available Soaring



How Does Al Work?



AI Context: Making Predictions Cheap

ARVARD BUSINESS REVIEW PRESS

Prediction Machines





The Simple Economics of Artificial Intelligence

AJAY JOSHUA GRAWAL GANS GO

How "Magic" Al Became Possible



Remarkable Improvements in Al



How AI Will Impact Infrastructure



Massive Investments in Al Infrastructure

Copy Link

≡ Bloomberg

The AI Race: Startups to Watch AI Glossary Model Collapse Risk AI's Real Carbon Footprint Small AI Models

Technology | Al

Amazon Bets \$150 Billion on Data Centers Required for Al Boom

Spending spree is a show of force as the company looks to retain cloud computing edge over Microsoft and Google.





An Amazon data center under construction near homes in Stone Ridge, Virginia. *Photographer:* Nathan Howard/Bloomberg

2024 Capex by Tech Majors

Amazon\$60 billionMeta\$37-\$40 billionMicrosoft\$50 billionGoogle\$50 billion

Rapid Growth in Data Centers

Market	Inventory (MW)	Y-o-Y Change (MW)	Available MW/ Vacancy Rate	Y-o-Y Change* (bps)	H1 2024 Net Absorption (MW)	C (Y-o-Y hange (MW)	Rental Rates (kW/ mo)**
Northern Virginia	2,611.1	357	38.6 / 1.5%	▲ 56	108.1	▼	-84.7	\$165-\$205
Dallas-Ft. Worth	591.0	91.6	26.0 / 4.4%	▲ 30	41.3	▼	-69.3	\$135-\$170
Chicago	589.6	222.1	11.2 / 1.9%	▼ -360	30.5		4.5	\$165-\$175
Phoenix	510.8	150.8	16.9 / 3.3%	- 200	148.1		104.3	\$170-\$210
Silicon Valley	459.2	48.5	29.2 / 6.4%	- 20	33.3		19.5	\$155-\$250
Hillsboro	427.4	179.0	0.3 / 0.07%	-260	171.2		93.5	\$140-\$180
Atlanta	310.0	39.0	27.3 / 8.8%	1 40	13.8		6.3	\$155-\$160
New York Tri-State	190.0	12.5	12.3 / 6.5%	- 330	0.0	▼	-3.4	\$170-\$180

*Vacancy Y-o-Y changes are calculated by comparing the difference between H1 2024 and H1 2023.

Figure 1. H1 2024 Wholesale Primary Market Fundamentals

**Rental rates are quoted asking rates for 250+ kW at N+1/Tier III requirements.

Source: CBRE Research, CBRE Data Center Solutions, H1 2024.

Sample Al Impacts: Northern VA

- Northern Virginia increased its inventory by 391.1MW YoY
- Record-low 0.9% vacancy rate driven by public cloud & AI companies.
- Rental rates surged by 41.6%. Tenants secured leases pre-construction.
- High electricity demand also boosted power costs by 20.8% YoY

Source: CBRE

Hyperscalers Drive Data Center Growth



- Hyperscale Data Centers Hit the Thousand Mark
- Total Capacity is Doubling Every Four Years

Concerns on Impact of Expansion

- "Unprecedented data center load growth" in multiple areas
- Potentially "all remnant capacity on the transmission system utilized"
- Could cause regional reliability issues.

Source: 2024 report by PJM Interconnection (PJM), a regional transmission organization (RTO) that manages the flow of electricity in 13 states and the District of Columbia.

Al Driving Demand for Nuclear

NATIONAL

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- Microsoft adding a new Data Center every three days!
- Google, Amazon have also signed deals for nuclear power
- Meta trying to power AI data center with small nuclear plant

Things Are Getting A Little Crazy!

CLIMATE / ENERGY / SCIENCE

Microsoft just made a huge, far-fromcertain bet on nuclear fusion



An end view of one of Helion's prototypes. Image: Helion

/ Scientists have been dreaming about nuclear fusion for decades. Microsoft thinks the technology is nearly ready to plug into the grid.

By Justine Calma, a senior science reporter covering climate change, clean energy, and environmental justice with more than a decade of experience. She is also the host of Hell or High Water: When Disaster Hits Home, a podcast from Vox Media and Audible Originals.

May 10, 2023, 6:00 AM PDT



If you buy something from a Verge link, Vox Media may earn a commission. See our ethics statement.

Why AI Is So Power Hungry





Each NVIDIA H100 Chip Draws 8x the Power of a Big Screen TV!

Why Is AI So Power Hungry



Generating an AI image can use as much power as charging a smart phone.

More and More Compute to Train Al



AI Will Be Leading Power Consumer

"...data centers could consume up to 16% of total US power by 2030, up 2.5% in 2022."

Source: Goldman Sachs Report

A New Balancing Act for Water

OREGON TECH

Google's water use is soaring in The Dalles, records show, with two more data centers to come

Updated: Feb. 22, 2023, 10:17 a.m. Published: Dec. 17, 2022, 7:04 a.m.



Google's annual water use in The Dalles, in gallons

Google's data centers in The Dalles use nearly three times more water than they did five years ago and now account for more than a quarter of all the city's water use.



Impact on Water Just Starting

Global AI demand could reach as much as 6.6 billion cubic meters in 2027, equal to half the fresh water consumption of the United Kingdom.

Source: Making AI Less "Thirsty": Uncovering and Addressing the Secret Water Footprint of AI Models

Water Usage Not Closely Tracked



Only 43% of data center operators currently track water usage.

Secondary/Tertiary Impacts

A look at the great transformer shortage affecting U.S. utilities

An NREL team finds that lead times for transformers has grown fourfold in three years, with orders sometimes taking two years. Additionally price increases of four to nine times have been reported in the past 3 years.

MARCH 7, 2024 ANNE FISCHER

ARKETS & POLICY



Image: Getty Images

"NREL study found that utilities are experiencing extended lead times for transformers of up to two years (a fourfold increase on pre-2022 lead times) and reporting price increases by as much as four to nine times in the past 3 years."

Secondary/Tertiary Impacts

 MARKETS INSIDER

NEWS > COMMODITIES

Al will nearly double demand for copper, which is already facing a global shortage

Filip De Mott Sep 16, 2024, 12:59 PM PDT

→ Share □ Save □ Save



(Photo by Yin Chao/VCG via Getty Images)

Data centers are less than 1% of copper demand, but that is expected to be 6 to 7% by 2050.

Yearly global copper demand will surge 72% from 30.4 million tons in 2021 to 52.5 million ton by 2050.

Source: BHP

AI Causing Political Backlash

Backlash to data centers prompts political upset in northern Virginia



Al Opportunities for Infrastructure



A generational opportunity to reimagine how we deliver services and manage cities and towns.

Al for First Response

JUSTICE AND PUBLIC SAFETY

Elk Grove, Calif., Introduces Drones as First Responders

The Elk Grove Police Department plans to add three aerial drones to assist in the line of duty, a trend that many law enforcement agencies have recently adopted to contribute to service.

🚹 🧰 🗙 🗗 🗨

July 16, 2024 • Marcus D. Smith, The Sacramento Bee



Al for Remote Inspections



LECTRIC UTILITY OPERATIONS

Southern Company System Granted FAA Waiver for Autonomous BVLOS Operations

June 22, 2023 📮

Southern Company's aerial services department can begin conducting dock-based, beyond visual line of sight (BVLOS) operations, enabling remote monitoring and asset inspections systemwide.

Add AI Smarts to Existing Infrastructure



"Instead of installing cameras at an intersection, if we know the trajectory of the vehicle, then the vehicle itself becomes the traffic sensor." -- Henry Liu, University of Michigan.

Al In the Satellites for Fire Spotting

♠ > OUTREACH AND INITIATIVES > SUSTAINABILITY

A breakthrough in wildfire detection: How a new constellation of satellites can detect smaller wildfires earlier

Sep 16, 2024 We're partnering with leading wildfire authorities to launch FireSat, a new global satellite constellation designed 2 min read specifically to detect and track wildfires the size of a classroom within 20 minutes.



< Share



Google Research created FireSat — a purpose-built constellation of satellites designed specifically to detect and track wildfires as small as 5x5 meters With high-resolution imagery updated globally every 20 minutes.

Extending the Cloud to the Edge



- Edge data centers located at cell towers
- Allow for more reliable real-time AI
- Low investment and modular
- Minimal environmental impact

Counter Model: Apple Intelligence



- Run AI most on the phone
- Goes the cloud for harder requests
- Reduces power costs, other impacts

What Does the Future Hold?



We really don't know.

But that's normal for big changes.

Thank you very much!







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