OpenAI

Infrastructure is Destiny

Economic Returns on US Investment in Democratic AI

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Overview

Revolutionary technology propels advances in infrastructure. Capital flows determine where and how the infrastructure is built. Those decisions determine whether a society leads or lags on technological innovation, often with far-reaching consequences. This is why infrastructure is destiny.

The United States leads the world today in development of artificial intelligence because of decisions made decades ago to install fiber-optic cables, coaxial lines and other broadband infrastructure that put the country at the forefront of the early digital revolution. The 1996 Telecommunications Act, with bipartisan support from forward-thinking lawmakers, reinforced the infrastructure as a national strategy.

As revolutionary as electricity, and promising similarly distributed access and benefits, AI can power a reindustrialization across the US, extend its global competitiveness, and boost national, state and household finances for the long term. Investment to extend the US lead in AI can yield tens of thousands of jobs; significant growth in GDP; a modernized, cleaner energy grid and energy policy, featuring nuclear power; and a state-of-the art network of semiconductor manufacturing facilities – invigorating local economies across the country. These are New Deal-sized stakes and scale.

Capital spending on AI already rivals the mainframe era of the late 1960s and the fiber optic deployment of the late 1990s[1] – with an estimated $175 billion in global infrastructure funds waiting to be committed.[2] The question is not whether that funding will flow, but where. If it doesn't flow into US-backed global infrastructure projects that advance a global AI that spreads the technology's benefits to the most people possible, then it will flow to China-backed projects that leverage AI to cement and expand autocratic power. There is no third option.

Analysts expect the build to require unprecedented scaling of compute. 2023 saw massive growth in demand for AI data centers – around 167% year-over-year[3] – that shows no sign of slowing. The total market for GPU and AI ASIC chips alone is expected to exceed $150 billion by 2025 and exceed $230 billion in 2029.[4] Goldman Sachs now estimates that around 47GW of incremental capacity is needed to serve data center-driven load growth in the US through 2030.

Earlier this year, OpenAI engaged outside experts to work with us on an analysis of the potential jobs and GDP impacts of building 5GW data centers in various locations across the US – to help inform conversations between industry and government about the economic benefits of this next stage of growth for Americans and their communities.

[1] A severe case of COVIDIA: prognosis for an AI-driven US equity market, JP Morgan, Sept. 3, 2024
[2] Global Infra Leaders 2024 Global Report, Houlihan Lokey Digital Infrastructure Industry Update Q2 2024, Preqin. Sum based on the following screening criteria: Asset Class: Infrastructure; Strategy: Core, Core-Plus, Debt, Opportunistic, Value Added; Sector: Energy, Renewable Energy, Telecommunications, Utilities
[3] OpenAI internal analysis, 2024
[4] Generative AI: Impacts on Processor, Memory, Advanced Packaging and Substrates, Yole Intelligence 2024

Based on computational demand trends for frontier AI models, we estimated at the time we undertook the analysis that a 5GW data center campus would meet the projected requirements, and that the profile of a single 5GW data center would include:

30 million square feet

14,000 construction workers

2 million GPUs

$100 billion in investment

$40 billion in annual revenue

Based on our resulting analysis, employment and GDP growth in the following example states would result from the construction of one 5GW data center:

State	New jobs created/supported*	Growth in GDP
Arizona	42,954	$ 6,908,848,125
California	38,327	$ 6,955,707,185
Georgia	43,861	$ 7,042,536,567
Michigan	41,900	$ 6,605,018,124
Nevada	36,321	$ 6,214,337,553
New York	33,204	$ 6,361,394,870
North Carolina	41,625	$ 6,629,619,203
Ohio	42,769	$ 6,783,610,663
Pennsylvania	40,996	$ 6,646,750,168
Texas	44,340	$ 7,128,132,155
West Virginia	34,324	$ 5,575,422,922
Wisconsin	40,253	$ 6,406,250,583

** 14,000 construction jobs + jobs supported through business-to-business transactions + jobs supported by worker spending. Totals differ due to jurisdictional differences in labor costs, etc. See Methodology for more details.*

Each data center is a hub of durable economic growth. In addition to new construction jobs, thousands of additional jobs will be supported in adjacent and related sectors, and more will be supported through an overall increase in local economic activity. All of this stems from data center investments. We estimate the **annual economic impacts** of operations for a single 5GW data center to be:

80 employees per 100MW of power, equaling 4,000 employees total

$27.97 billion in cost of revenue and operating expenses

Estimating $40 billion in annual revenue[5] and using 2028 dollars to allow for construction, OpenAI calculates the following annual impacts:

State	Net new jobs created/supported*	Growth in GDP
Arizona	46,595	$ 19,667,170,624
California	36,371	$ 17,991,414,075
Georgia	46,404	$ 19,376,372,902
Michigan	48,720	$ 19,334,237,823
Nevada	35,730	$ 17,706,285,785
New York	37,314	$ 19,926,313,370
North Carolina	43,391	$ 19,434,623,329
Ohio	41,050	$ 18,384,464,952
Pennsylvania	42,130	$ 19,148,832,827
Texas	48,279	$ 20,396,059,524
West Virginia	31,671	$ 16,186,312,913
Wisconsin	38,512	$ 17,725,148,272

** 4,000 jobs + jobs supported through business-to-business transactions such as power, utilities and building operations + jobs supported by worker spending. Totals differ due to jurisdictional differences in labor costs, etc. See Methodology for more details.*

[5] OpenAI internal analysis

The CHIPS Act has been a strong first step toward onshoring leading-edge semiconductor manufacturing. Construction of new manufacturing facilities to boost computing power already is driving growth in US GDP,[6] but this is just one front in the required forward movement on infrastructure – the next front is unprecedented investment in data centers and power, propelled by policies that support new energy and data center capacity.

Who will control the future of AI is the urgent question of our time. The rapid progress being made means that we face a strategic choice about what kind of world we are going to live in – one in which the US and allied nations advance a global AI that spreads the technology's benefits and opens access to it, or one in which China and other nations that don't share our values use AI to cement and expand their power?

[6] Bloomberg, Aug. 22, 2024

China's Infrastructure Surge At-a-Glance

The US currently has a lead in AI development, but continued leadership is far from guaranteed. Authoritarian governments the world over are willing to spend enormous amounts of money to catch up and ultimately overtake us. The People's Republic of China aims to be the global leader in AI by 2030.

China's AI ecosystem

- China already counts more than 230 LLMs, more than 180 of which have been approved for public use by the government.
- Notable GPT-4o level AI models include: Alibaba's Qwen2, 01AI Yi-34b, SenseTime 5.5, WuDao, and Baidu Ernie 4.0. DeepSeek-Coder-V2 outperforms GPT-4 Turbo on evals.
- These models excel at Chinese language tasks.

Hallmarks of China's infrastructure build

- Recently approved 11 nuclear reactors across five sites – an investment of at least 220 billion yuan ($31 billion), with construction expected to take about five years. More nuclear reactors under construction than any other nation in the world: 10 new reactors approved per year for each of the last two years.[7]
- 17 AI Pilot Zones to help grow its AI industry via financial support and favorable local regulation.
- For its "Eastern Data and Western Computing" project, a fully integrated national computing network, eight national computing power hubs planned to enable "supercomputing-as-a-service", providing more efficient access to advanced compute.
- Its Digital Silk Road initiative supported the development of 155 AI-related projects in 64 countries between 2000 and 2017.[8]
- The initiative also supports "Luban Workshops" vocational training program to develop IT talent across the Global South, including 30 workshops in 25 countries between 2016-2023.
- Through Safe City/Smart City, Huawei, ZTE Corporation, Hikvision, Dahua, Alibaba and others deploy AI to make city services more efficient, focusing on improvements to traffic flow, logistics, law enforcement and more.

China's compute capacity goals

- China is #2 in global compute capacity behind the US.
- On target to hit 300 EFLOPS by 2025.

[7] Bloomberg, Aug. 19, 2024
[8] RAND

Data Center Impacts on Jobs and GDP

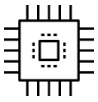
Unprecedented investment is required for the US to secure its economic and national security. This investment will in turn yield economic benefits at a scale and speed not seen since the New Deal nearly a century ago. The jobs and GDP calculations below only begin to reveal the magnitude of this transformation since they don't include construction of new energy sources or actual semiconductor manufacturing.

Each data center is a hub of durable economic growth. In addition to new construction jobs, thousands of additional jobs will be supported in adjacent and related sectors, and more will be supported through an overall increase in local economic activity. All of this stems from data center investments. Based on our internal analysis, the sample states below would see the following impacts from construction of one 5GW data center:

For the economic impacts of construction of one 5GW data center:

30 million square feet

14,000 construction workers



2 million GPUs

$100 billion in investment

$40 billion in annual revenue

For the annual economic impacts of operations for a single 5GW data center:

80 employees per 100MW of power, equaling 4,000 employees total

$27.97 billion in cost of revenue and operating expenses[9]

An estimated $40 billion in annual revenue[10]

2028 dollars to allow for time for construction

[9] OpenAI internal analysis
[10] OpenAI internal analysis

Arizona

14,000 NEW CONSTRUCTION JOBS

Supports **7,127 jobs in the community**	**21,828 jobs through spending**
Totaling **42,955 jobs** created and supported	
Altogether driving **$5,299,407,046** in labor income	
Altogether driving **$6,908,848,125** in GDP	

4,000 NEW DATA CENTER JOBS

Supports **26,016 jobs in the community**	**16,580 jobs through spending**
Totaling **46,596 jobs** created and supported	
Altogether driving **$4,105,372,491** in labor income	
Altogether driving **$19,667,170,624** in GDP	

California

14,000 NEW CONSTRUCTION JOBS

Supports **6,469 jobs in the community**	**17,859 jobs through spending**
Totaling **38,328 jobs** created and supported	
Altogether driving **$5,360,948,132** in labor income	
Altogether driving **$6,955,707,185** in GDP	

4,000 NEW DATA CENTER JOBS

Supports **19,883 jobs in the community**	**12,487 jobs through spending**
Totaling **36,3710jobs** created and supported	
Altogether driving **$3,798,627,358** in labor income	
Altogether driving **$17,991,414,075** in GDP	

Georgia

14,000 NEW CONSTRUCTION JOBS

Supports **8,291 jobs in the community**	**21,570 jobs through spending**
Totaling **43,861 jobs** created and supported	
Altogether driving **$5,343,820,222** in labor income	
Altogether driving **$7,042,536,567** in GDP	

4,000 NEW DATA CENTER JOBS

Supports **26,794 jobs in the community**	**15,610 jobs through spending**
Totaling **46,404 jobs** created and supported	
Altogether driving **$3,953,811,509** in labor income	
Altogether driving **$19,376,372,902** in GDP	

Michigan

14,000 NEW CONSTRUCTION JOBS

Supports **6,852 jobs in the community**	**21,048 jobs through spending**
Totaling **41,900 jobs** created and supported	
Altogether driving **$5,243,794,293** in labor income	
Altogether driving **$6,605,018,124** in GDP	

4,000 NEW DATA CENTER JOBS

Supports **28,137 jobs in the community**	**16,583 jobs through spending**
Totaling **48,720 jobs** created and supported	
Altogether driving **$4,240,891,539** in labor income	
Altogether driving **$19,334,237,823** in GDP	

Nevada

14,000 NEW CONSTRUCTION JOBS

Supports **5,654 jobs in the community**	**16,667 jobs through spending**
Totaling **36,321 jobs** created and supported	
Altogether driving **$4,848,326,114** in labor income	
Altogether driving **$6,214,337,553** in GDP	

4,000 NEW DATA CENTER JOBS

Supports **21,704 jobs in the community**	**10,026 jobs through spending**
Totaling **35,730 jobs** created and supported	
Altogether driving **$2,982,962,556** in labor income	
Altogether driving **$17,706,285,785** in GDP	

New York

14,000 NEW CONSTRUCTION JOBS

Supports **4,798 jobs in the community**	**14,406 jobs through spending**
Totaling **33,204 jobs** created and supported	
Altogether driving **$5,038,954,668** in labor income	
Altogether driving **$6,335,283,722** in GDP	

4,000 NEW DATA CENTER JOBS

Supports **20,018 jobs in the community**	**13,296 jobs through spending**
Totaling **37,314 jobs** created and supported	
Altogether driving **$4,732,634,953** in labor income	
Altogether driving **$19,926,313,370** in GDP	

North Carolina

14,000 NEW CONSTRUCTION JOBS

Supports **8,067 jobs in the community**	**19,558 jobs through spending**
Totaling **41,625 jobs** created and supported	
Altogether driving **$5,174,063,070** in labor income	
Altogether driving **$6,599,133,242** in GDP	

4,000 NEW DATA CENTER JOBS

Supports **24,793 jobs in the community**	**14,598 jobs through spending**
Totaling **43,391 jobs** created and supported	
Altogether driving **$3,959,860,878** in labor income	
Altogether driving **$19,434,623,329** in GDP	

Ohio

14,000 NEW CONSTRUCTION JOBS

Supports **7,237 jobs in the community**	**21,531 jobs through spending**
Totaling **42,769 jobs** created and supported	
Altogether driving **$5,219,380,379** in labor income	
Altogether driving **$6,783,610,663** in GDP	

4,000 NEW DATA CENTER JOBS

Supports **23,572 jobs in the community**	**13,477 jobs through spending**
Totaling **41,050 jobs** created and supported	
Altogether driving **$3,355,222,269** in labor income	
Altogether driving **$18,384,464,952** in GDP	

Pennsylvania

14,000 NEW CONSTRUCTION JOBS

Supports **6,463 jobs in the community**	**20,533 jobs through spending**
Totaling **40,996 jobs** created and supported	
Altogether driving **$5,328,712,024** in labor income	
Altogether driving **$6,646,750,168** in GDP	

4,000 NEW DATA CENTER JOBS

Supports **22,732 jobs in the community**	**15,398 jobs through spending**
Totaling **42,130 jobs** created and supported	
Altogether driving **$4,087,935,836** in labor income	
Altogether driving **$19,148,832,827** in GDP	

Texas

14,000 NEW CONSTRUCTION JOBS

Supports **8,378 jobs in the community**	**21,962 jobs through spending**
Totaling **44,340 jobs** created and supported	
Altogether driving **$5,454,255,837** in labor income	
Altogether driving **$7,128,132,155** in GDP	

4,000 NEW DATA CENTER JOBS

Supports **27,933 jobs in the community**	**16,346 jobs through spending**
Totaling **48,279 jobs** created and supported	
Altogether driving **$4,154,308,157** in labor income	
Altogether driving **$20,396,059,524** in GDP	

West Virginia

14,000 NEW CONSTRUCTION JOBS

Supports **5,180 jobs in the community**	**15,144 jobs through spending**
Totaling **34,324 jobs** created and supported	
Altogether driving **$4,595,664,845** in labor income	
Altogether driving **$5,575,422,922** in GDP	

4,000 NEW DATA CENTER JOBS

Supports **19,706 jobs in the community**	**7,965 jobs through spending**
Totaling **31,671 jobs** created and supported	
Altogether driving **$2,519,169,092** in labor income	
Altogether driving **$16,186,312,913** in GDP	

Wisconsin

14,000 NEW CONSTRUCTION JOBS

Supports **6,730 jobs in the community**	**19,523 jobs through spending**
Totaling **40,253 jobs** created and supported	
Altogether driving **$5,107,814,872** in labor income	
Altogether driving **$6,406,250,583** in GDP	

4,000 NEW DATA CENTER JOBS

Supports **23,051 jobs in the community**	**11,461 jobs through spending**
Totaling **38,512 jobs** created and supported	
Altogether driving **$3,076,909,505** in labor income	
Altogether driving **$17,725,148,272** in GDP	

Conclusion

The infrastructure build needed to sustain the US edge on AI development is the kind of visionary undertaking for which the country is uniquely known and equipped to execute – a massive effort shaped by democratic values and designed to broadly distribute economic benefits. In contrast, China's top-down, centralized AI infrastructure strategy presents a real and competitive alternative shaped by autocratic values that would deploy the technology and dole out the benefits in ways that cement its own influence.

The US can only meet this challenge through the kind of partnership between government and industry that creates conditions at home – attracting investment and spurring rapid construction – to enable us to build tomorrow's infrastructure today.

Methodology

The economic impact analysis included in this report does not account for the building of any newly required energy infrastructure or semiconductor manufacturing that would occur d to support new data centers – meaning the economic impact estimates in this report are intentionally low.

To calculate economic impacts, this report uses an input-output model developed by IMPLAN.[11] IMPLAN's model is designed to capture all monetary market transactions between industries in a given time period. The resulting mathematical formulae allow for examinations of the effects of a change in one or several economic activities on an entire economy (impact analysis). For more information on IMPLAN, and their assumptions made as part of their input-output analyses, refer to the articles on Input-Output Analysis and Assumptions and Detailed Key Assumptions of IMPLAN & Input- Output Analysis.

Based on IMPLAN's input-output tables, a set of multipliers that reflects the capital investments and operating expenditures from potential data centers were created to derive GDP, employment and labor income estimates. All operating expense categories were included in GDP, Labor Income and Employment calculations. For capital investments, only building construction categories were included in GDP, Labor Income and Employment calculations, using regional and industry average income data. Networking, Computer & IT Equipment, and Software were excluded from the capital investment estimates.

[11] IMPLAN® model, 2022 Data, using inputs provided by the user and IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Dr., Suite 120, Huntersville, NC 28078. www.IMPLAN.com