Powering Data Centers: Economic Implications

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Agenda

- Introduction
- Topic overview
- Energy Sources
- Potential impacts
- Scenario Modeling
- Conclusion / Notable Results
- Q&A

How Did Data Centers Become Popular?

Artificial Intelligence

- Global artificial intelligence investment has grown more than threefold since 2020
- AI funding jumped from roughly $75 billion in 2020 to peaks surpassing $580 billion recently

Cloud Computing

- Cloud computing is growing at a massive rate
- The global cloud market is currently valued at over $1.11 trillion
- Expanding by about 15% to 21% every year.

Data Centers & Energy, at a Glance

Always-On Load

Servers, storage, and networking draw power continuously, not just at peak hours.

Cooling Overhead

Cooling systems can add significant load on top of raw computing power demand.

Concentrated Draw

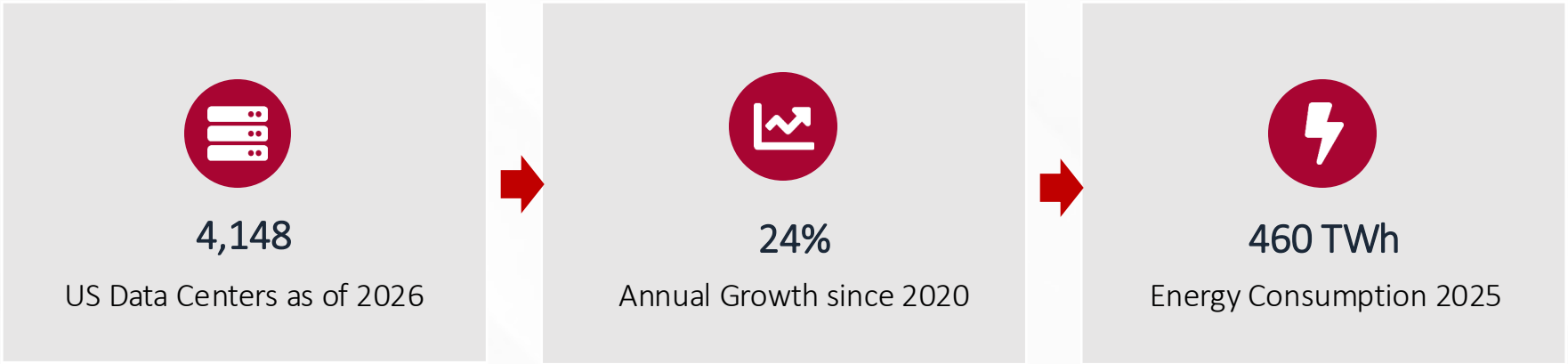
A single large campus can use as much electricity as a mid-size city.

Location-Bound

Sites are chosen for grid access, land, water, and fiber connectivity.

Current Data Center Landscape

The rapid expansion of artificial intelligence, cloud computing, and digital services is driving unprecedented investment in data center infrastructure. As demand for computing power accelerates, so does the need for reliable, affordable, and sustainable energy.



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The Growing Demand for Data Centers

Digital infrastructure is now core infrastructure

Cloud computing, streaming, e-commerce, and enterprise IT all depend on data center capacity, the same way earlier economies depended on power plants and highways.

The AI race has national and corporate stakes

Governments and companies view compute capacity as a competitiveness issue, accelerating permitting and investment even amid local pushback.

There is no ready substitute

Unlike some infrastructure debates, there is no widely deployed alternative to physical servers for delivering cloud and AI services at scale.

Capital is already committed

Large sums of planned investment from hyperscalers and investors create strong momentum behind continued build-out.

Economic Disadvantages

Water Consumption

Cooling large facilities can draw millions of gallons annually, competing with local agricultural and residential use.

Grid Strain & Rates

Concentrated demand can raise electricity rates for neighboring homes and businesses if the grid is not upgraded in step.

Land Use & Noise

Large campuses and their cooling equipment change the character of rural and suburban land, with constant fan and generator noise.

Community Pushback

Residents often feel decisions are made without their input, fueling distrust even where projects bring investment.

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Energy Sources for Data Centers: The Good and the Bad

The Good

Solar & Wind (with storage)

Zero-emission power, increasingly paired with batteries for round-the-clock reliability.

Nuclear & Small Modular Reactors

High-density, carbon-free baseload power well matched to constant data center load.

Grid-Interactive Agreements

Facilities that flex demand and add local grid capacity rather than just drawing from it.

The Bad

Coal Plants

High-emission generation kept online or expanded specifically to serve new campuses.

Diesel Backup Overuse

Backup generators intended for emergencies running routinely for peak-shaving, adding local air pollution.

Unplanned Gas Peaker Reliance

Fast-tracked gas plants built ahead of grid planning, locking in decades of emissions.

Innovation is Changing the Conversation

Can we build them better?

Foundational Innovations

- SMRs
- Renewable integration
- Grid modernization
- Battery storage
- More efficient cooling

Emerging & Green Innovations

- On-site solar & wind microgrids
- Waste-heat recovery & reuse
- Grid-interactive demand flexibility
- Geothermal power

Energy innovation creates new opportunities to reduce community impacts.

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Why Economic Modeling?

- You need a ***software solution*** that can clarify, calculate and communicate a ***quantitative narrative*** to policy makers and the general public about policies for your economy.
- Economic policy modeling can help agencies forecast the effects of policies before they are implemented
- Guide Policy-making Process
  - *Formalize your decision-making process*
  - *Get policy right*
  - *Pass/Block legislation*
  - *Modernize and advance your agency*
- Bidders for grants, contracts from data center and power plant development will want to demonstrate that their proposals will have a positive economic impact in host communities and remain competitive
- Policy organizations and regional planners can use models to add quantitative rigor to their proposals, making the benefits clearer to stakeholders and decision-makers

REMI Analysis Apple Data Center

This document presents an analysis of the Apple Data Center project proposed by the **Iowa Economic Development Authority, completed by the Iowa Department of Revenue** using the Regional Economic Models. REMI was used to analyze the expected impact of the project, such as the change in employment and tax revenues the State of Iowa expects to experience as the result of the Apple Data Center project locating within its borders.

Project Information and Assumptions

- **Construction costs** : estimated to be around $17.5 million in 2018, $208.3 million in 2019, $190.8 in 2020, $190.8 in 2021, and $47.7 in 2022.
- **Equipment cost** : $22.5 million in 2020 and $22.5 million in 2022 when each building is expected to be completed.
- **Computer equipment cost** : $300 million in 2020 and $300 million in 2022.
- In 2019, 5 direct jobs will be created at the Waukee location. In 2020, an additional 22 direct jobs will be created. In 2022, an additional 23 jobs will be created.

Apple Data Center Study Results

Projected Changes in Private Employment by Industry

Table 1. Projected Changes in Private Employment by Industry between 2018 and 2030

Calendar Year	Construction	Scientific, and Technical Services	Manufacturing	Wholesale Trade	Retail Trade	Transportation and Warehousing	Information	Finance and Insurance	Real Estate and Rental and Leasing	Administrative and Waste Management Services	Educational Services	Health Care and Social Assistance	Arts, Entertainment, and Recreation	Accommodation and Food Services	Other Services	Total
2018	128	3	4	2	14	1	1	3	1	2	1	7	1	4	6	178
2019	1,482	31	44	23	156	16	11	32	14	22	7	88	11	47	68	2,052
2020	1,311	38	209	24	156	16	34	31	13	27	7	90	11	47	67	2,081
2021	1,266	28	34	19	124	12	32	23	10	19	6	72	8	36	52	1,741
2022	304	19	153	8	48	5	53	9	4	14	2	28	3	15	19	684
2023	-3	5	-2	-1	-2	-1	51	-2	-1	3	0	-3	0	0	-3	41
2024	-5	5	-2	0	-1	0	51	-1	0	3	0	-2	0	1	-1	48
2025	0	6	-1	0	4	1	51	0	1	5	0	2	0	3	1	73
2026	0	7	0	0	4	1	51	1	1	5	0	2	0	3	1	76
2027	0	7	0	0	5	1	51	1	1	5	0	2	0	4	2	79
2028	0	7	0	0	5	1	52	1	1	5	0	2	0	4	2	80
2029	0	7	1	0	5	1	52	1	1	5	0	3	1	4	2	83
2030	0	7	1	1	5	1	52	1	1	5	0	3	1	4	2	84

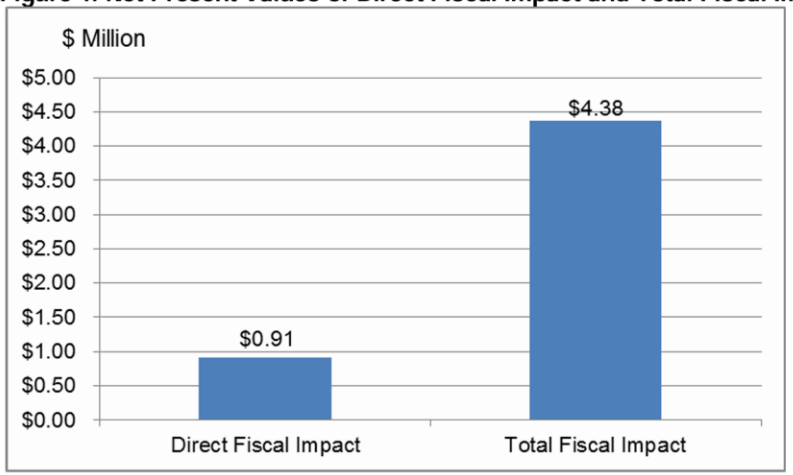
Projected Changes in Personal Income between 2018 and 2023

Table 2. Projected Changes in Personal Income between 2018 and 2030

Calendar Year	Baseline Personal Income ($ Million)	Forecasted Personal Income ($ Million)	Income Change ($ Million)	Income Change as Percent of Baseline
2018	$147,767	$147,777	$10.60	0.0072%
2019	$153,786	$153,913	$127.70	0.0830%
2020	$160,051	$160,190	$138.89	0.0868%
2021	$166,916	$167,034	$117.37	0.0703%
2022	$173,313	$173,365	$51.90	0.0299%
2023	$180,348	$180,350	$2.06	0.0011%

Direct and Total Fiscal Impact

Figure 1. Net Present Values of Direct Fiscal Impact and Total Fiscal Impact, 2018-2030



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Scenario Modeling

Research Question: "What are the economic implications of different approaches to powering data centers?"

Scenario 1

- Data Center in California
- Electricity pulled from the grid or non-renewable source.
- Negative amenity and non-monetary economic effects are modeled.

Scenario 2

- Data Center in California with SMR and renewable energy.
- With power plant construction
- Macroeconomic long-term effects are modeled and compared to our previous scenario.

Scenario Introduction

Research Question: "What are the economic implications of different approaches to powering data centers?"

Scenario #1 New Data Center in California

- **Fuel** : Electricity from US power grid
- **Size** : 1.5-2 million sq. Ft, 400-acre campus
- Modeled with a negative amenity aspect to show how it can make a region unattractive. (represents non-monetary aspects of a region, noise, pollution, water consumption)
- **Purpose** : To analyze the economic effects of a data center with low population growth as a result of non-pecuniary aspects and rising utility costs.

Scenario 1 Inputs

Construction Investment – Capital spending associated with building the data center (Site preparation, construction and supporting infrastructure)

Operations - Ongoing economic activity generated by facility operations, maintenance, and employment

Negative Amenity – Represents community impacts

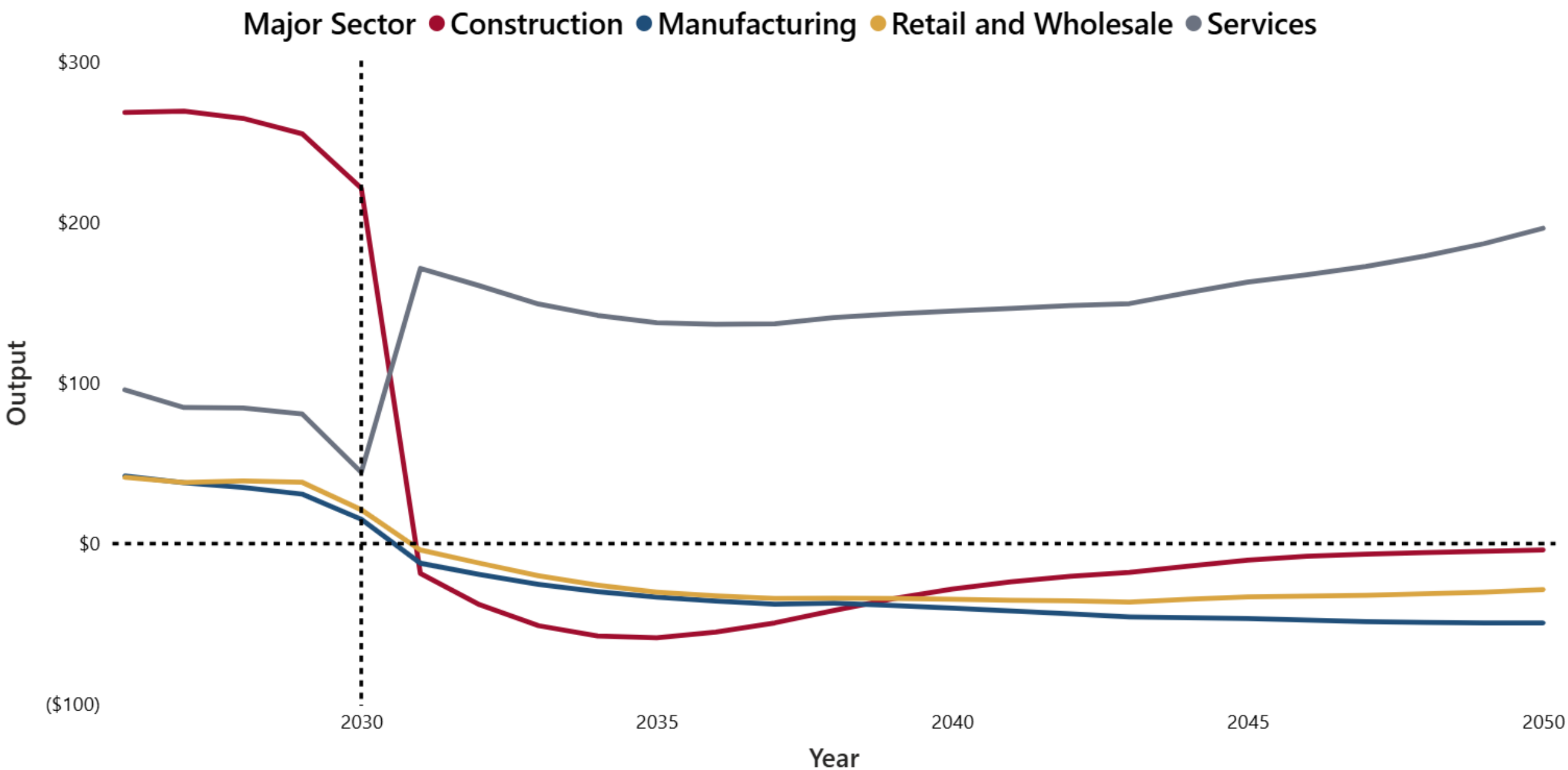
Policy Variable	Industry	Units	Time Frame	Annual Total
Detailed Industry Sales	Power and communication structures	Nominal $ (Millions)	2026-2029	$250
Industry Employment	Computing infrastructure providers, data processing, web hosting, and related service	Jobs	2030-2050	200
Non-Pecuniary (Amenity) Aspects	Total	Nominal $ (Billions)	2030-2050	-$1

Employment by Major Sector

Units: Jobs

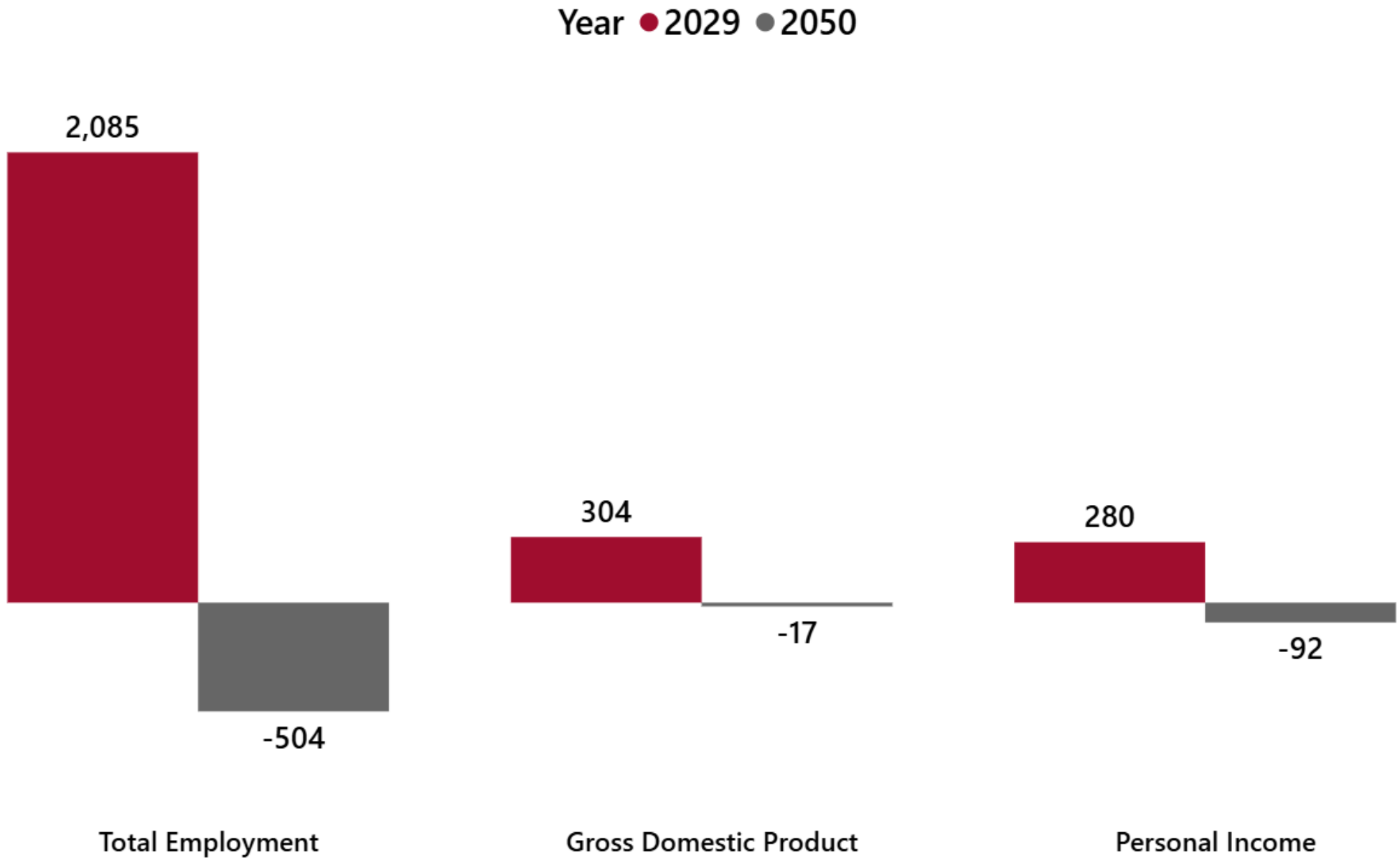
Output by Major Sector

Units: Millions of Dollars



Construction vs Operations Phase

Employment Units: Jobs | GDP and Income Units: Millions of Dollars



Scenario 2 Introduction

Research Question: "What are the economic implications of different approaches to powering data centers?"

Scenario #2 New Data Center in California

- **Fuel** : Powered by SMR and renewable energy
- **Size** : 1.5-2 million sq. Ft, 400-acre campus
- Negative amenity is removed due to the cleaner power source.
- **Purpose** : To analyze the economic effects of a data center with a renewable power plant instead of electricity pulled from US power grid.

Scenario 2 Inputs

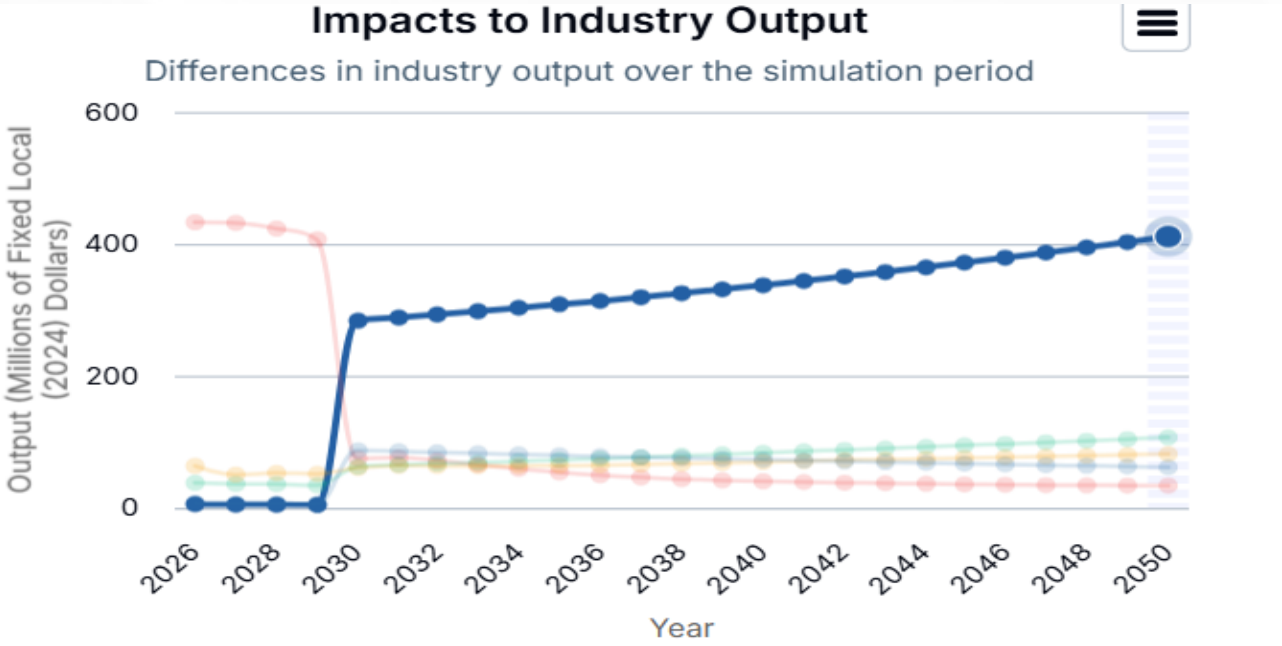
Data Center Operational Employment - representing the employment necessary to run the facility.

Facility and Power Plant Construction - capital investment for construction of the power plant that supplies renewable energy to the Kairos data center.

Power Plant Output Instead of Grid Electricity - Introduces additional energy generation into the regional economy to meet the data center's long-term energy demand without concern for congesting US power grid. Negative amenity is removed.

Policy Variable	Industry	Units	Time Frame	Annual Total
Detailed Industry Sales	Power and communication structures	Nominal $ (Millions)	2026-2029	$250
Industry Employment	Computing infrastructure providers, data processing, web hosting, and related service	Jobs	2030-2050	200
Detailed Industry Sales	Power and communication structures	Nominal $ (Millions)	2026-2029	$250
Industry Sales	Electric Power Generation	Nominal $ (Millions)	2030-2050	$87.6

Scenario 2 Output Results



- Construction
- Data Processing; Hosting and related services
- Professional, Scientific, and Technical Services
- Real Estate

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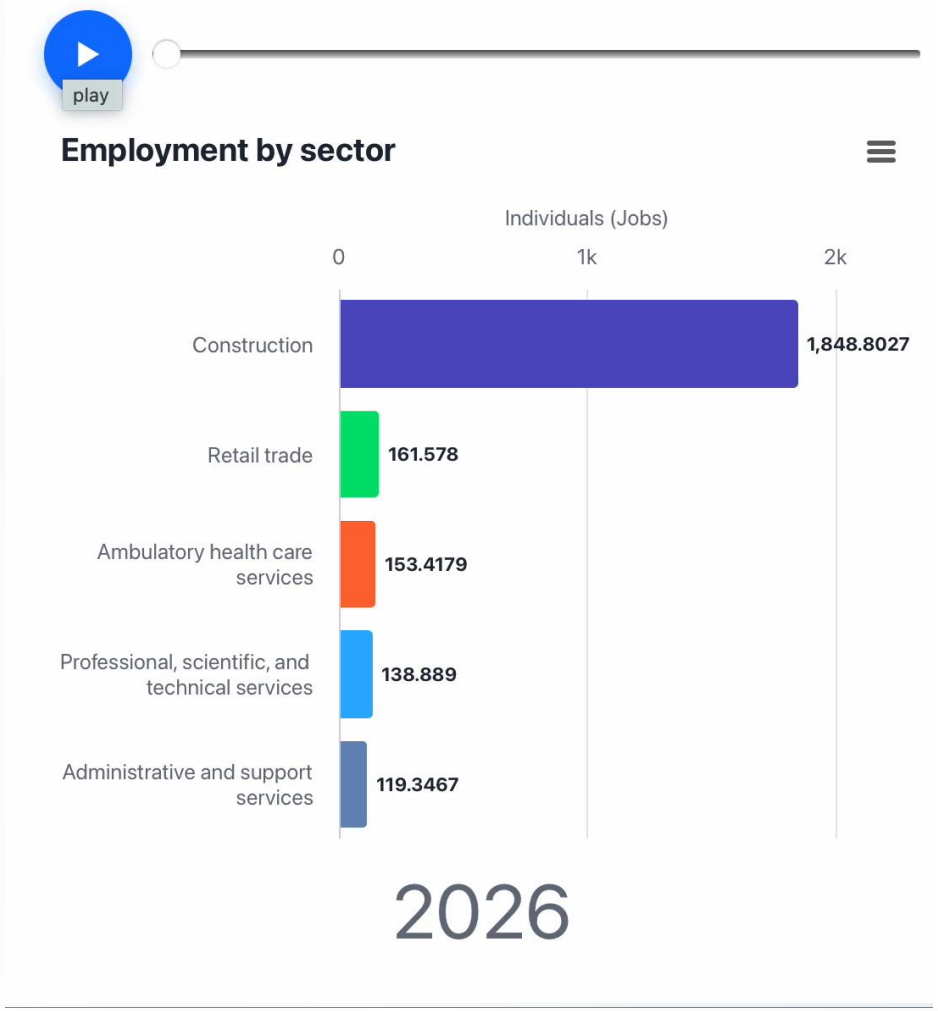
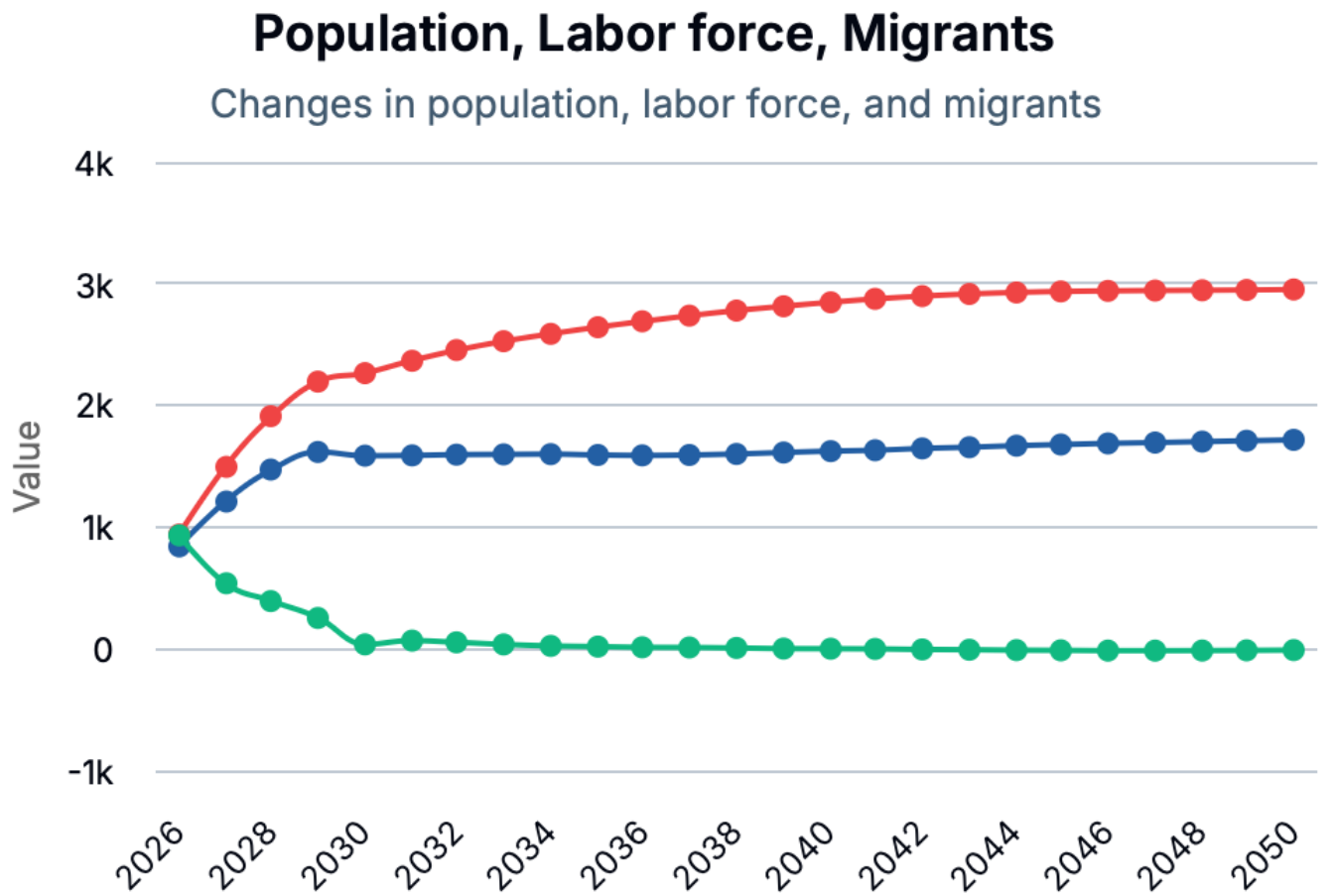
Scenario 2 Employment Results





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Population Labor Force Migrants

Scenario 2 Fiscal Impacts

Revenue Category	Units	2026	2030	2035	2040	2045	2050
Corporate Taxes	Millions of Fixed 2022 Dollars	$2.0	$1.8	$1.9	$2.0	$2.2	$2.3
Income Taxes	Millions of Fixed 2022 Dollars	$17.1	$12.9	$14.0	$15.2	$16.8	$18.5
Other Revenues	Millions of Fixed 2022 Dollars	$28.4	$26.3	$30.0	$33.2	$36.2	$39.3
Property Taxes	Millions of Fixed 2022 Dollars	$0.5	$0.4	$0.4	$0.5	$0.5	$0.6
Sales Taxes	Millions of Fixed 2022 Dollars	$10.2	$8.2	$10.3	$11.5	$12.7	$14.0
Total	**Millions of Fixed 2022 Dollars**	**$58.2**	**$49.5**	**$56.7**	**$62.4**	**$68.4**	**$74.7**

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Conclusions and Notable Results

Scenario 1

- Decrease in GDP
- Decrease in Personal Income
- Loss of about 504 jobs by 2050

Reason

- Massive amounts of economic migration and population decline
- Likely due to increase in utility costs and non-pecuniary aspects like noise pollution and lack of environmental sustainability.

Scenario 2

- Growth in output after construction
- Growth in population
- Growth in labor force
- Decline in economic migration
- Increase in tax revenue after construction

Reason

- Renewable energy easing environmental concerns
- Relieves congested electric grid and prevents rising utility costs.

Thank you for attending!

For more information, please contact
info@remi.com