Data Center Water and Electricity Consumption in Nevada

Erik M. Henzl
Sean A. McKenna, PhD

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Division of Hydrologic Sciences, Desert Research Institute

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EXECUTIVE SUMMARY

Data centers are essential for supporting the digital infrastructure that provide for the storage, management, and distribution of information (Siddik *et al.*, 2021). In 2024, S&P Global recognized 40 data centers in Nevada. Although Nevada's data center market is still relatively small compared to larger markets like Northern Virginia, it is among the fastest growing in the United States (Thompson *et al.*, 2024; Roberts, 2025a, 2025b; NLR, 2025). Nevada's cost-competitive energy, abundant land, and attractive tax and regulatory environment create a unique value proposition for data center investment (Young, 2025a; Smith, 2024; Temple, 2025). However, Nevada's emergence as a data center hotspot entails various challenges. The concentration of data centers could stress local grids and necessitate the expansion of grid infrastructure. This may contribute to growing concerns that the costs of digital services are disproportionately borne by local utilities and ratepayers (National Academies, 2025; Srivathsan *et al.*, 2024; Spencer and Singh, 2024; IEA, 2025). Additional challenges may include potential resource constraints, supply chain disruptions, rising costs, shortages of generation infrastructure and skilled trade workers, and the growing interconnection queue (WECC, 2024; Lee *et al.*, 2025; Green *et al.*, 2024; Arun, 2025). Furthermore, satisfying rising energy demand from data center expansion may necessitate trade-offs with other priorities such as electrification, manufacturing, and affordability (IEA, 2025). These considerations are pertinent to Nevada provided NV Energy's (2024b) steep projected load growth.

In 2024, Nevada had about 40 data centers comprising 22 percent (8.6 TWh) of the state's electricity generation capacity. S&P Global estimated that this could reach 35 percent (14.8 TWh) of forecasted generation by 2030 (Thompson *et al.*, 2024), though NV Energy projects steeper growth. NV Energy (2024b) established that 12 data center projects will fuel load growth of 957 GWh at Nevada Power and 24,633 GWh at Sierra Pacific Power by 2033. In a high-medium-low framework, this paper finds that these projects will consume considerable amounts of electricity and water. Following an eight-year buildout to 2033, water volumes between 5,021 and 37,343 acre-feet may be annually consumed for data center cooling. Data centers may indirectly consume an additional 12,448 acre-feet in electricity generation each year. These water needs imply considerable costs. The annual cost of water for data center cooling following the eight-year expansion totals $551,000 to $4.09 million. The annual cost of water for electricity generation amounts to an additional $1.36 million. Moreover, the approximate price of the 25,590 GWh totals more than $2.8 billion each year. Variation in estimated water demand and costs is attributable to the difference between the highest and lowest efficiency modeling scenarios. The results summarized below reflect the medium efficiency scenario, based on the industry's average water usage effectiveness (WUE):

- Medium WUE: 0.465 L/kWh
- Water Demand (Cooling): 9,647 acre-feet
- Water Cost (Cooling): $1.06 million

- Electricity Price: $2.806 billion
- Water Demand (Electricity): 12,448 acre-feet
- Water Cost (Electricity): $1.36 million.

As the 12 announced data center projects range in size, their corresponding energy and water needs will vary. Variation in data center size and resource-intensity complicates efforts to define an "average" data center. While many data centers are 5 to 10 MW, hyperscale facilities (100 to 200+ MW) are becoming increasingly standard (Spencer and Singh, 2024; Srivathsan *et al*., 2024). Ultimately, as the above results make clear, the combined needs of the 12 announced data center projects in Nevada are likely to be substantial. These projects represent the unique opportunity of positioning Nevada as a key player in the digital world. Inherent to this opportunity, however, are challenges of growing resource scarcity that must be navigated through careful planning and decision-making.

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LIST OF ACRONYMS

AFY	Acre-feet per year
AWC	Available water capacity
BTU	British Thermal Unit (1 million BTUs/hour = 293 kW)
CONUS	Contiguous United States
GW	Gigawatts
GWh	Gigawatt-hours
IRP	Integrated Resource Plan
kW	Kilowatt
kWh	Kilowatt-hours
LBNL	Lawrence Berkeley National Library
TWh	Terawatt-hour
NREL	National Renewable Energy Laboratory
NLR	National Laboratory of the Rockies
GPU	Graphics Processing Unit
CPU	Central Processing Unit
DLC	Direct Liquid Cooling
TRIC	Tahoe-Reno Industrial Center
C&I	Commercial and Industrial
WECC	Western Electricity Coordinating Council
LTRA	Long-Term Reliability Assessment
L/kWh	Liters per kWh
WUE	Water Usage Effectiveness
UPW	Ultrapure Water
TMWRF	Truckee Meadows Water Reclamation Facility
PPAs	Power Purchase Agreements
PUE	Power Usage Effectiveness

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DATA CENTER EXPANSION

Data centers play an integral role in the storage, management, and distribution of data. They house servers, digital storage equipment, and network infrastructure, which underpin large-scale data processing and storage essential in areas such as finance, healthcare, and transportation. This infrastructure supports businesses, universities, governments, and the individuals relying on these institutions. However, data centers are energy- and water-intensive, requiring vast quantities of both to satisfy data processing and storage needs. Electricity is consumed directly through data center operations, and it may be indirectly consumed in groundwater pumping and water treatment. Water is consumed directly for cooling in chillers, cooling towers, and liquid cooling systems, and indirectly through electricity generation (Siddik *et al*., 2021; Spindler *et al*., 2024; Mytton, 2021; Anderson, 2023; IEA, 2025; Bothwell and Walsh, 2025). Water and electricity are also consumed upstream in the data center value chain from resource extraction to IT equipment manufacturing. While this paper primarily focuses on water and electricity consumed directly in data center operations and indirectly in electricity generation, the water-intensity of GPU manufacturing is also briefly discussed.

Existing and emerging technologies amplify demand for data processing and storage, exponentially increasing data center workloads. Generative AI requires enormous computational power, and AI-ready data centers are especially energy- and water-intensive due to their high average power densities. In this way, data centers have grown considerably with regards to energy and water consumption. To illustrate this computational growth, 30-MW facilities dominated 10 years ago while 200+-MW hyperscale facilities are being constructed today (Srivathsan *et al*., 2024; Lee *et al*., 2024; Li *et al*., 2023). For example, the “boutique” Webb Data Center in Reno plans to use 28.5 MW and will purportedly consume two acre-feet of water per year (Young, 2025a). In contrast, larger data centers consume much more. Vantage Data Centers is building a 224-MW facility in Storey County (Vantage Data Centers, 2025). Moreover, Google’s data center in Henderson consumed more than 630 acre-feet in 2024 (Google, 2025). While energy efficiency improvements combined with advancements in storage-drive density have made data centers more efficient over time, there is still uncertainty in whether further advancements could offset rapid demand growth (Siddik *et al*., 2021; Srivathsan *et al*., 2024).

Box 1. Defining Power and Energy

Energy is the capacity to perform work; power is the rate at which work is performed (i.e. the rate at which energy is expended or transmitted). The product of power (watts) and the time (hours) over which it is used is energy (watt hours). This report discusses future loads and capacities in units of power (gigawatts or GW) and consumption in units of energy (gigawatt-hours or GWh).

In Nevada and across the United States, data centers represent an increasing share of electricity and water consumption. The Lawrence Berkeley National Laboratory (LBNL) estimated that while data centers consumed approximately 4.4 percent (176 TWh) of total electricity in the U.S. in 2023, this number is projected to reach 6.7 to 12 percent (325 to 580 TWh) by 2028 (Shehabi *et al*., 2024). The International Energy Agency (IEA) supports this estimate in projecting U.S. data center electricity consumption to reach 426 TWh in 2030 (IEA, 2025). The U.S. drives a considerable share of global data center electricity consumption as the fastest growing data center market. In 2024, the U.S. had a total installed data center capacity of 42 GW, which will increase to an estimated 100 GW by 2030. Demand growth is largely fueled by increasing digitalization, cloud migration, and AI technology (Green *et al*., 2024; Srivathsan *et al*., 2024; IEA, 2025). In Nevada, S&P Global estimated that data centers consumed approximately 22 percent (8.6 TWh) of the state's electricity generation capacity in 2024, and that it may reach 35 percent (14.8 TWh) of forecasted generation by 2030 (Thompson *et al*., 2024).[1] Notably, this is considerably less than the additional 25.6 TWh that NV Energy (2024b) forecasts by 2033. The rapid pace of data center expansion currently outpaces efficiency improvements in cooling and hardware, thereby surging electricity demand (Poudineh, 2025).

This increase in electricity demand also drives the water consumed in data center cooling. Data center water consumption may vary depending on cooling technology, local climate conditions, and the source of electricity (IEA, 2025). Since more water is used indirectly for non-renewable electricity generation, indirect water consumption will increase if rising electricity demand is not met using less water-intensive renewable sources. Indirect water consumption will also increase if generated electricity is used inefficiently (Mytton, 2021). In 2023, U.S. data centers consumed 66 billion liters (53,507 ac-ft) of water. Presently, a 100-MW hyperscale data center in the U.S. consumes, on average, about 2 million liters (1.6 ac-ft) per day. By 2028, U.S. hyperscale data centers are expected to annually consume between 60 and 124 billion liters (between 48,643 and 100,528 ac-ft) (Shehabi *et al*., 2024; IEA, 2025). In looking at global water consumption, data centers now consume approximately 560 billion liters (454,000 ac-ft) per year, and this could reach 1.2 trillion liters (972,856 ac-ft) per year in 2030 (IEA, 2025).

Data center expansion is pertinent to Nevada since the state is already home to numerous data centers, and several data center projects have been announced. The reason for the rapid growth of data centers in Nevada is the state's unique value proposition, which includes a combination of geographic, infrastructural, and economic advantages. The proximity to key markets, including the Bay Area, in addition to the availability of cost-competitive and clean energy sources (e.g. geothermal and solar) makes Nevada an economically and geographically

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[1] According to the Energy Information Administration (2025a, 2025d), Nevada is the sixth-lowest energy producer in the U.S., consuming more than 10 times what the state produces. In 2023, total energy production amounted to approximately 66 trillion Btu while energy consumption totaled 689.4 trillion Btu. At the same time, however, Nevada's electricity generation typically exceeds consumption, and the state has consistently exported supplies to other states since 2019.

strategic location for data centers. Furthermore, tax breaks and streamlined regulatory processes for data centers make Nevada attractive for investment. In addition to there being no corporate income tax in Nevada, data centers can claim tax abatements of 75 percent for personal property taxes and 2 percent for sales taxes for 10 or 20 years (contingent upon approval from the Governor's Office of Economic Development) (Young, 2025a; Smith, 2024; NV Energy, 2024a; Temple, 2025). For these reasons, Nevada stands out as an opportune space for data center expansion and will likely play a central role in this rapidly growing market.

The evolution of Nevada into a data center hub presents both opportunities and challenges. Data center expansion may contribute to local economies through job creation, taxes, infrastructure development, and community investment. Additionally, data center development may attract ancillary industries providing energy, security, consulting, and other services in addition to businesses with latency-sensitive services (JLL, 2025).[2] For example, Google has invested more than $2.2 billion in Nevada since 2019, supporting more than 2,500 jobs and annually contributing about $309 million to the state's GDP (Google, 2024).[3] Data centers may also boost local renewable energy and infrastructure development, potentially enhancing grid strength and reliability (JLL, 2025). This, however, depends on how the costs of infrastructure upgrades are distributed.

There are now more than 40 data centers in Nevada divided between at least 16 operators. The state's data center market is split between Reno and Las Vegas. While the market is still relatively small in comparison to larger markets like Northern Virginia and Phoenix, Arizona, the high-growth trajectory of data centers in Nevada (particularly Northern Nevada) positions the state to surpass more established national markets (Thompson *et al*., 2024; Data Center Map, 2025). This is made clear in Table 1. While operating capacity in Nevada (about 713 MW) is still small compared to Loudoun County, Virginia (5,334 MW) and Maricopa County, Arizona (2,160 MW), Nevada is experiencing data center growth comparable to these established markets (NLR, 2025).[4]

The current and proposed data center infrastructure in the U.S. has been assembled by the National Laboratory of the Rockies (NLR) (formerly the National Renewable Energy Laboratory) and is shown in Figure 1 (Roberts, 2025b). In early 2025, NLR identified the Truckee Meadows region in northern Nevada as one of the top three fastest growing data center markets in the U.S., along with the Phoenix metropolitan area and Northern Virginia (Roberts, 2025a).

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[2] In looking at data from 20.5 million user sessions, Deloitte (2020) observed that each 0.1 second improvement in latency yielded an 8.4% increase in conversions among retail customers, a 9.2% increase in average order value, and a 5.2% increase in customer engagement.

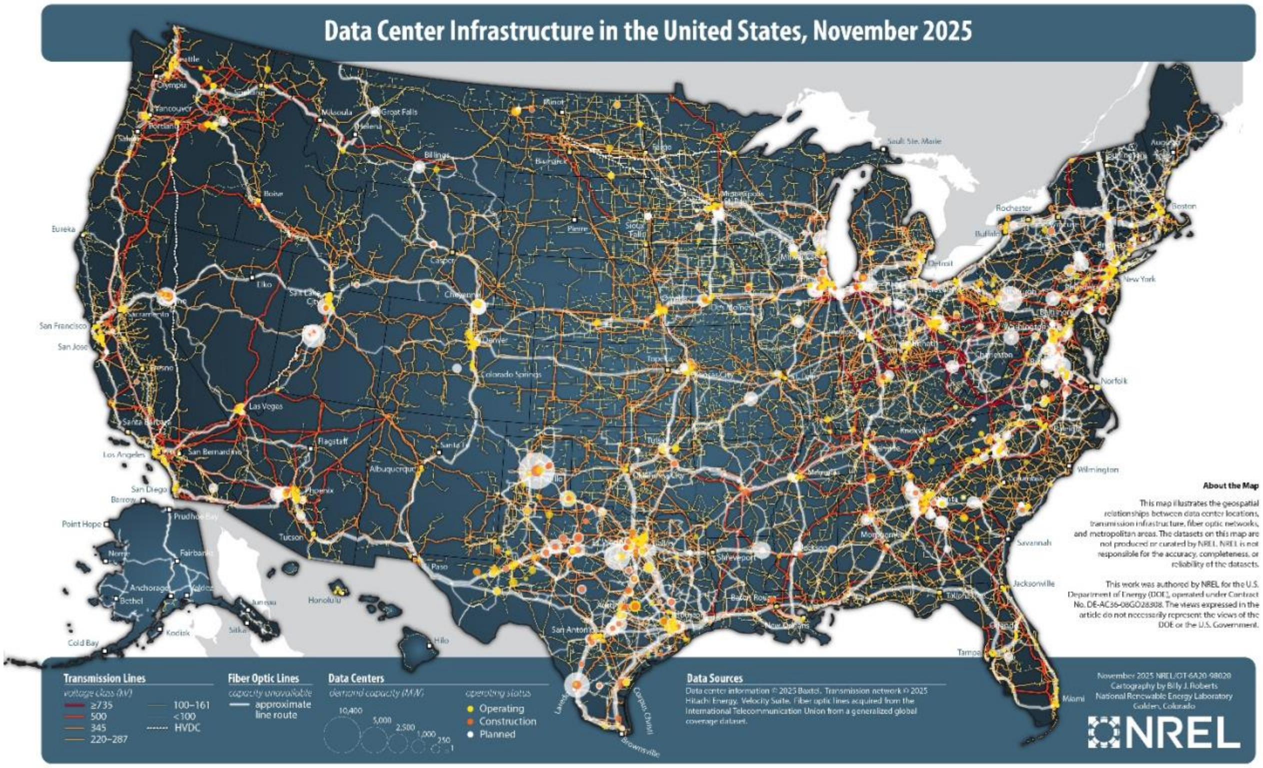
[3] Job creation can be broken down into 390 direct jobs, 1,540 indirect jobs, and 665 induced jobs. Annual GDP contributions can also be separated into $173 million direct, $58 million indirect, and $77 million induced (Google, 2024).

[4] The National Laboratory of the Rockies created an interactive map of U.S. data center demand capacity by county, which reflects the most current conditions surrounding data center expansion across the country (NLR, 2025).

Table 1. Data Center Demand Capacity (MW) in Nevada Compared to Established Markets.

	Washoe, NV	Storey, NV	Clark, NV	Nevada Total	Loudoun, VA	Maricopa, AZ
Operating	216.5	70	426.33	712.83	5,333.67	2,159.6
In Construction	20	475	0	495	596	1,276.5
Planned	5	5,495	414	5,914	6,349.4	5,966
Total	241.5	6,040	840.33	7,121.83	12,279.07	9,402.1

Based on more recent data, northern Nevada remains one of the fastest growing markets in the country and even ranks among the top five emerging markets globally (McWilliams *et al*., 2025). In contrast to both the Phoenix and Virginia locations, however, the electricity transmission infrastructure in the Truckee Meadows region does not currently include any 500-kilovolt, or larger, transmission lines. While data center expansion stands as an important opportunity for Nevada to grow as a key player in the digital world, there are various challenges to sustaining this rapid growth.



About the Map

This map illustrates the geospatial relationships between data center locations, transmission infrastructure, fiber optic networks, and metropolitan areas. The datasets on this map are not produced or curated by NREL. NREL is not responsible for the accuracy, completeness, or reliability of the datasets.

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Data Sources

Data center information © 2025 Baxtel. Transmission network © 2025 Hitachi Energy. Velocity Suite. Fiber optic lines acquired from the International Telecommunication Union from a generalized global coverage dataset.

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Cartography by Billy J. Roberts
National Renewable Energy Laboratory
Golden, Colorado

Figure 1. Map of current and proposed data centers and the supporting energy infrastructure in the United States (Roberts, 2025b).

CHALLENGES TO DATA CENTER EXPANSION

Numerous challenges may limit data center expansion. Chief among them is the spatial concentration of data centers, which can stress local grids while creating additional challenges (e.g. grid expansion, equipment updates, and associated costs). The concentration of large data center energy loads often necessitates additions to network infrastructure (i.e. new generation resources and transmission infrastructure), which can take years to complete and requires considerable capital investment. As a result, data center operators now face the challenge of sourcing sufficient energy supplies, and local grids may increasingly struggle to keep up with rising demand while balancing stakeholder needs (Metz *et al*., 2025; Poudineh, 2025; Srivathsan *et al*., 2024; Jafari *et al*., 2024; WECC, 2024; Spencer and Singh, 2024; IEA, 2025). For these reasons, some have raised criticisms that the concentration of data centers has the effect of disproportionately imposing costs on local utilities and ratepayers who effectively subsidize AI and computing services (National Academies, 2025).[5] According to the IEA, approximately half of U.S. data center capacity and half of U.S. data centers being developed are in pre-existing regional clusters, which increases risks of local energy transmission bottlenecks. While established hubs still attract a large share of the capacity under development, developers have increasingly announced projects in emerging markets like Nevada (IEA, 2025). The issue of concentration relative to energy needs and transmission is therefore of paramount importance to Nevada as it grows into a data center hotspot.

Energy demand is exposed to further risk through the increasing variability of the energy system. Over the next decade, the simultaneous addition of variable resources (renewables) and retirement of baseload resources (primarily coal and natural gas) increases system variability with the potential to exacerbate challenges in system planning and operation. As Western states increasingly adopt renewable portfolio standards and carbon-free electricity targets (like Nevada's 50 percent by 2030 goal), resource portfolios are reoriented and clean baseload energy, such as geothermal and batteries providing longer-duration energy storage, will have to play a larger role. Project delays and cancellations are attributable to supply chain issues, which have impacted both new and existing facilities. Specifically, lead times for transformers, breakers, and other equipment have increased considerably, causing significant delays in the expansion, upgrade, and replacement of transmission infrastructure. As a result, over the past six years in the West, only 76 percent of planned resource additions have come online (WECC, 2024). Rapid demand growth combined with shrinking resource margins means that if resource buildout continues at this pace, the West risks hundreds of hours each year without sufficient dispatchable energy (WECC, 2024; NV Energy, 2024b). This issue is vital for Nevada as NV Energy

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[5] In their Q2 *State of the Market Report* for PJM Interconnection (the largest grid operator in the U.S., whose service territory includes Northern Virginia), Monitoring Analytics recognized that large data center loads imposed higher capacity market and transmission costs on other customers. Wholesale energy prices increased by 41.4%, from \$53.86/MWh in the first six months of 2024 to \$76.15/MWh in the first six months of 2025. Real-time load-weighted average prices increased by 63.2% during the same period, from \$31.70/MWh to \$51.75/MWh. The tightening supply and demand balance and resultant high prices are primarily attributable to "almost inexhaustible" data center demand (Monitoring Analytics, 2025).

forecasts steep data center load growth coupled with the retirement of 19 GW of resources through 2034. As dispatchable generation falls with the retirement of generators starting in 2026, the resource mix grows more variable, thereby exposing the energy system to increased risk of supply deficits during extreme summer heat conditions (NV Energy, 2024b). In these ways, reliable access to power stands as an emerging bottleneck for data center expansion. There are, however, additional challenges that exacerbate the threat of network infrastructure bottlenecks (Thompson *et al*., 2024).

Additional threats to data center expansion in Nevada and the state's energy system include supply chain disruptions, increased costs, the growing scarcity of generation infrastructure (e.g. gas turbines), and the shortage of skilled trade workers. Disruptions to supply chains have the effect of slowing the construction of new projects and the interconnection of generating resources. While access to chips (GPUs and CPUs) can already be challenging, further supply chain disruptions can occur from power and cooling to network infrastructure (WECC, 2024; Lee *et al*., 2025). Simultaneously, rising costs threaten supply shortfalls. Rising material costs for wind and solar, transmission expansion, and plant equipment in addition to high interest rates — which have increased capital costs for energy projects — further intensify the risk of resource deficits. Already, there exists a scarcity of natural gas turbines as manufacturers face a combination of overwhelming demand growth and rising project development costs. The dearth of skilled electrical trade workers further compromises the ability to deliver planned resources (Green *et al*., 2024; Arun, 2025; WECC, 2024). Should the energy sector fail in building out the needed supplies and infrastructure, meeting data center load growth may necessitate trade-offs with other priorities like electrification, manufacturing, and affordability (IEA, 2025).[6] These are important considerations for Nevada based on the immense forecasted data center load growth combined with the potential for supply deficits.

As increasing energy system variability and supply chain instability pose considerable risk to meeting demands, the growing interconnection queue compromises our ability to get new supplies online. The interconnection queue — the accumulation of new generation projects awaiting approval for connection to the grid — has grown eightfold nationwide over the past 10 years. This growth has been fueled by the abundance of new clean energy connection requests that outpace the expansion of transmission infrastructure. Increased project timelines and rising interconnection costs create additional barriers to getting new projects online (NCSL, 2025; WECC, 2024). The ever-growing interconnection queue contributes to grid stress, and the planned additions over the next 10 years will exacerbate this stress. These issues are pertinent to Nevada as the state's interconnection queue totals nearly 76 GW, making it the ninth largest in the U.S. This means that 76 GW of developing generation projects are awaiting connection to the

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[6] This is made clear in Virginia. As of August 2025, electricity prices increased approximately 13 percent in Virginia versus 6 percent nationally compared to August 2024 prices (Venkat and Anderson, 2025). Public health costs are also projected to rise in the region due to rising data center emissions. Han *et al.* (2025) estimate that data centers in Virginia may already drive $220 to $300 million in annual public health costs.

grid with an average wait time of 51 months in Nevada.[7] In comparison, Nevada's 2024 net summer capacity was 16.7 GW, and net generation was 45,528 GWh.[8] As host communities grow increasingly concerned over the impacts of data center expansion on local resources, questions arise concerning energy affordability and how rising costs will be allocated (Lee *et al*., 2024; WECC, 2024; Thompson *et al*., 2024; Energy Information Administration, 2025a, 2025d).

Growing data center demands may exacerbate competition for scarce resources. With regards to water resources, data centers collectively consume billions of gallons each year (IEA, 2025; Shehabi *et al*., 2024). Due to water's superior thermal conductivity compared to air, which makes it more efficient and cost-effective, it is a preferred method for data center cooling. Water cooling can reduce a data center's electricity needs, but it increases the facility's water footprint (Anderson, 2023). This can be problematic in exacerbating water stress, particularly in Nevada where the effects of drought are salient (Siddik *et al*., 2021; Metz *et al*., 2025). Nevada also faces the issue of groundwater basin over-appropriation. Approximately 50 percent of the state's groundwater basins are over-appropriated, and 25 percent are over-appropriated by more than two times the basin's perennial yield (Nevada Legislative Counsel Bureau, 2019; Nevada Division of Water Resources, 2023). Additional water stress in water-scarce regions may have adverse economic impacts such as increased water prices and decreased farm productivity (Spindler *et al*., 2024).[9] These factors are pertinent to Nevada as reductions in water supplies can jeopardize farm and ranch profitability (Taylor *et al*., 2021).

Overall, data center expansion may place enormous stress on local land, water, and energy resources. The rapid pace of expansion has prompted some jurisdictions to pause new data center projects (Spencer and Singh, 2024). This is apparent in Nevada where data centers have rapidly proliferated in recent years, and several new projects have been announced. In February 2025, this rapid growth motivated Reno's Planning Commission to vote in favor of recommending that the city temporarily pause data center permitting. This would provide time for the city to determine the local environmental and economic impacts of data center expansion (Young, 2025b). Additional community resistance to data center expansion may revolve around environmental concerns. Such concern was expressed by the Sierra Club Toiyabe Chapter in appealing the approval of the Webb Data Center, which will be sited within Reno city limits. Growing pushback makes clear the concern that some community stakeholders have for potentially negative impacts to the environment and to Nevada's ability to achieve energy sustainability and conservation goals (Girnus, 2025).

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[7] The two energy technologies comprising the bulk of Nevada's interconnection queue are solar (60 percent) and battery storage (32 percent) (Thompson *et al*., 2024).

[8] Net summer capacity is the maximum power output that can be supplied by generating resources during peak summer demand. Net generation refers to the difference between total energy generation and the energy consumed at generating stations (Energy Information Administration, 2025c).

[9] This issue is already abundantly clear in Uruguay, where people protested Google's plans to open a data center as intense drought conditions were already threatening agricultural productivity (Martinez, 2023).

While data center electricity and water demand can be extensive, there are some innovations that may help alleviate this pressure. Advanced cooling technologies like direct liquid cooling (DLC) and immersion cooling have the potential to significantly reduce direct water consumption. Furthermore, AI has the potential to enhance grid planning and operations through the optimization of supply and demand forecasting, weather modeling, and real-time assessment of potential system imbalances. These measures are important in improving resource utilization, lowering system costs, and reinforcing grid stability (IEA, 2025; Bothwell and Walsh, 2025). The culmination of these factors introduces uncertainty in the extent of U.S. electricity demand growth (and, thus, indirect water consumption). DeepSeek — a Chinese AI startup — has already demonstrated significantly greater capital and resource efficiencies in AI development and training. The increasing adoption of cheaper, more energy-efficient AI models could therefore reduce electricity demand growth. Conversely, lower costs for using AI inference could fuel greater use, thereby increasing electricity demand (German, 2025; Kearney and Hampton, 2025; Bothwell and Walsh, 2025). Efficiency gains made through other hardware and software improvements may also inadvertently drive use (National Academies, 2025). This same concern can be expressed for water consumption. While efficiency improvements can decrease water consumption per use, overall consumption may increase as the demand for AI and its scale of application grows (Li *et al.*, 2023).[10] How data center water use is accounted for may add to these uncertainties. According to Schroeder Law Offices, for example, recent change applications for groundwater at the Tahoe-Reno Industrial Center (TRIC) show municipal use and do not indicate the extent to which these uses will be consumptive (Nadeau *et al.*, 2025). Combined, these factors ultimately add to uncertainty in data center resource-intensity.

The challenges of data center expansion are crucial to Nevada and should be considered in data center project plans. According to NV Energy, 39 bundled-service projects are forecast to drive "unprecedented" load growth amounting to approximately 7,600 MW of capacity additions. Of these projects, 12 are data centers requesting 5,900 MW of capacity by 2033, driving anticipated load growth of 957 GWh at Nevada Power and 24,633 GWh at Sierra Pacific Power. Nevada Power's service territory is mainly in Southern Nevada and includes the Apex Industrial Park in Las Vegas. Sierra's service territory includes much of Northern Nevada, including TRIC. A majority of the forecasted load growth occurs within Sierra's service territory due to the demands of large commercial and industrial (C&I) customers, particularly data centers. Data centers requested 3,820 MW of incremental capacity at TRIC whereas 390 MW were requested at Apex (NV Energy, 2024b).

This significant forecasted load growth combined with the retirement of 19 GW of resources from 2023 through 2034 contributes to increasing loss-of-load hours and overall grid stress. Notably, the 25,590 GWh in data center load growth outlined by NV Energy (2024b) is more than half of Nevada's net generation in 2024 (Energy Information Administration, 2025a,

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[10] This dynamic is known as Jevons paradox, "[...] the idea that increasing efficiency leads to higher overall consumption rather than savings" (National Academies, 2025).

2025d). Furthermore, based on the Western Electricity Coordinating Council's (WECC's) Long-Term Reliability Assessment (LTRA) for the Northwest subregion (including Nevada), adequate supplies are available until the summer of 2032 and remain insufficient thereafter. Likewise, probabilistic assessment results evince a potential for energy or capacity deficits, particularly during extreme summer heat conditions after 2024 (NV Energy, 2024b).

ANALYSIS AND DISCUSSION

Given Nevada's rapid transformation into a data center hub combined with the potential for resource shortfalls, anticipating the state's water and energy demand for data center expansion is critically important. The following analysis seeks to estimate water and electricity demand for data centers, and the costs of these resources, based on NV Energy's forecasted load growth. The analysis assumes that each project will be completed. Though NLR recognizes a high degree of uncertainty in the completion rate of planned projects (NLR, 2025), the industry's high pre-leasing rates with colocation vacancy approaching zero percent suggests that many projects are likely to be completed (Batson, 2025). Estimates of water and energy demand are provided for both the eight-year buildout period (2025-2033) and then for annual consumption in 2033 and beyond.

Box 2. Methodology

Estimates of data center water demand are based on data center load growth (25,590 GWh by 2033) as projected by NV Energy, recognizing the relationship between energy and water consumption.

For estimates of annual post-buildout data center water demand (Equation 1), we multiply data center energy demand (25,590 GWh) by a different WUE value in a high-medium-low framework. We then divide by 1,233,481.8 to convert units from liters to acre-feet. The medium-efficiency scenario was calculated as follows:

$$(1) \qquad 0.465 \text{ L/kWh} \times 25{,}590{,}000{,}000 \text{ kWh} \times \frac{1 \text{ ac-ft}}{1{,}233{,}481.8 \text{ L}} = 9{,}647 \text{ ac-ft.}$$

For water demand estimates throughout the expansion to 2033 (Equation 2), we assume linear load growth. This means that an equal share of the load is added each year, compounding over the course of the expansion period. Calculations for the medium-efficiency scenario continue in this way, where *n* is the number of years in the buildout:

$$(2) \qquad \sum_{n=1}^{8} \frac{n}{8} \times 9{,}647 \text{ ac-ft} = 43{,}411 \text{ ac-ft.}$$

Estimates of data center energy demand during the buildout were calculated in the same way. Electricity costs assume a rate of \$0.09/kWh, and water costs assume a leasing price of \$90/AFY. Equation 3 shows the calculation for annual post-buildout water costs, and Equation 4 shows the calculation for water costs incurred throughout the eight-year expansion.

Both model the medium-efficiency scenario and account for 2.5% inflation. Electricity costs were calculated using the same method.

$$(3) \quad 9{,}647 \text{ ac-ft} \times \$90/\text{ac-ft} \times 1.025^{8} = \$1{,}057{,}850$$

$$(4) \quad \sum_{n=1}^{8} \frac{n}{8} \times 9{,}647\text{ac-ft} \times \$90 \times 1.025^{(n-1)} = \$4{,}389{,}350.$$

While estimates are expressed as exact values (e.g. 9,647 acre-feet), they are still estimates that reflect the most current publicly available information in addition to the abovementioned assumptions. Various factors such as potential efficiency improvements, project completion rates, supply chain disruptions, and other economic uncertainties (e.g. tariffs) represent potential sources of inaccuracy.

As previously stated, 12 data center projects fuel anticipated load growth of 957 GWh at Nevada Power and 24,633 GWh at Sierra Pacific Power by 2033. The generation of this electricity will require water. At a rate of 0.6 liters per kWh (L/kWh) (NV Energy, 2023), the generation of 25,590 GWh demands 12,448 acre-feet of water. However, this electricity will not be generated all at once; rather, it will be generated over a period of eight years. Assuming linear growth over time, this implies an addition of 3,199 GWh per year, compounding to approximately 115,155 GWh over the eight-year expansion. With respect to water, this anticipated load growth will add an additional 1,556 acre-feet for each year of the expansion. Ultimately, 56,015 acre-feet will be needed for electricity generation throughout the eight-year buildout since water demand compounds as electricity generation scales over the expansion period. This is considered an indirect use of water for data centers as it is separate from water used for cooling and other on-site purposes.

Vast quantities of water may be required for data center cooling.[11] The amount of water a data center uses depends on its water usage effectiveness (WUE), a measure of how much water a facility uses compared to its energy consumption (L/kWh). Hence, lower WUE values, getting closer to zero, indicate that a facility's water usage is more efficient. Industry-wide WUE values range depending on data center type and efficiency practices. In 2016, LBNL estimated an average WUE of 1.8 L/kWh for all U.S. data centers (Shehabi *et al*., 2016). More recently, LBNL determined that the industry's 2023 average WUE was 0.36 L/kWh. For the period 2023 to 2028, WUE is projected to increase to 0.45 to 0.48 L/kWh due to the increased water consumption of cooling systems (Shehabi *et al*., 2024). Some industry players, however, exhibit higher levels of efficiency (lower WUEs).[12] Meta, for example, reported a WUE of 0.18 L/kWh

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[11] Temple (2025) reported that Nevada's 12 announced data center projects could consume between 860 million and 5.7 billion gallons (2,639 to 17,493 acre-feet) of water per year for cooling in addition to 15.5 billion gallons (47,568 acre-feet) for electricity generation. This analysis finds that the water needed for cooling may fall within this range, though annual water demand for electricity generation may be lower.

[12] Some reports indicate that at least one key industry player, Amazon, has sought to obfuscate their total data center water use (Barratt and Furneaux, 2025).

for 2023 and a five-year (2019-2023) average WUE of 0.242 L/kWh (Meta, 2024). The range of WUE values expressed here are used in the following high-medium-low framework for estimating water usage for cooling in data centers:

- Low: 0.242 L/kWh
- Medium: 0.465 L/kWh
- High: 1.8 L/kWh.

Using these WUE values and the 25,590 GWh of anticipated load growth from announced data center projects in Nevada yields the below estimates of water needed for data center cooling throughout the eight-year expansion. Between 628 and 4,668 acre-feet may be added yearly, compounding over the expansion period to 2033. As a result, 22,593 to 168,044 acre-feet may be directly consumed for data center cooling throughout the expansion:

- Low: 22,593 acre-feet
- Medium: 43,411 acre-feet
- High: 168,044 acre-feet.

Once the buildout is complete, and the 25,590 GWh load becomes integrated into NV Energy's new baseload, the water needed annually for data center cooling may range from 5,021 to 37,343 acre-feet depending on the WUE:

- Low: 5,021 acre-feet
- Medium: 9,647 acre-feet
- High: 37,343 acre-feet.

Data center water demand is also driven by GPU manufacturing, though to a lesser extent than electricity generation and cooling. Although this additional use is likely borne outside of Nevada at the site of manufacturing, it remains an important consideration for data center development, especially given how rapidly chip technology has advanced to accommodate increasing data center workloads (IEA, 2025; Mims, 2020). While some uncertainty in this indirect water use stems from a lack of clarity in the water consumption factor per chip, some reasonable estimates do exist. In surveying the sustainability reports of 28 chip manufacturers, Wang *et al*. (2023) found an average water use of 8.22 L/cm^2 of product. Assuming a die size of 814 mm^2 (the size of Nvidia's H100), the implied water consumption per chip is approximately 67 liters. Additionally, the need for ultrapure water (UPW), which is used to prevent chip damage from impurities, is a considerable driver of the industry's water demand. Some estimates suggest that an average chip manufacturing facility consumes approximately 10 million gallons of UPW per day, though manufacturers can recycle upwards of 90 percent of this (James, 2024; Irwin-Hunt, 2023). This would imply a net consumption of about one million gallons of UPW per day (1,120 AFY). The water consumed in chip manufacturing per data center also depends on the quantity of chips per facility. On average, Meta has 12,500 chips per data center (i.e. 350,000 chips across 28 data centers globally) (Clark, 2024; Meta, 2025), though other facilities may use more or fewer chips.

In applying the water consumption factor (8.22 L/cm ^{2} of product) reported by Wang *et al*. (2023), approximately 0.68 acre-feet is consumed in GPU manufacturing for an average Meta data center (assuming 12,500 chips). If each of the 12 announced data center projects in Nevada are comparable to the average Meta data center, then these projects may require a total of approximately 8.16 acre-feet for GPU manufacturing. Typically, IT equipment has a lifetime of four to six years. However, rapid technological advancement may shorten equipment replacement cycles (IEA, 2025; Mims, 2020; MITechNews, 2024).[13] GPU manufacturing therefore adds to the indirect water consumption of data centers, although these additional water needs would likely be satisfied outside of Nevada at the site of manufacturing.

Between electricity generation, cooling, and GPU manufacturing, data centers in Nevada may consume considerable quantities of water. The Tahoe-Reno Industrial Center (TRIC) is a large, mixed-use industrial park home to various industrial and commercial businesses with rapid growth of data centers (see Temple, 2025) including the Switch Citadel Campus. An agreement is in place to enable use of reclaimed water from the Truckee Meadows Water Reclamation Facility (TMWRF) to meet current and future demands at TRIC. Water is delivered from TMWRF to TRIC through a pipeline with a 4,000-AFY capacity. Additional treatment of the pipeline water may be needed for cooling use and the water may also serve other non-cooling industrial uses at TRIC. [14] This analysis considers that some of the water from this pipeline may be used to address data center cooling at TRIC. This analysis additionally assumes that there is no cost for the pipeline water, but there are most likely pumping and maintenance costs that are not considered here. Thus, the estimates of water demand within Sierra's service territory consider the use of zero percent, 10 percent (400 acre-feet), and 100 percent (4,000 acre-feet) of the pipeline water in satisfying cooling water needs. Moreover, new groundwater appropriations — which may be available at reduced prices in remote areas with little existing development — may also help in satisfying data center water demand. However, interbasin transfers have been largely unsuccessful in recent years,[15] and the issue remains controversial. Figure 2 models the water required annually for data center cooling (with and without the pipeline) and generation of the projected 24,633 GWh in load growth at Sierra following the eight-year buildout. Notably, water needed for electricity generation will not be addressed by the pipeline and must instead be satisfied using other water resources.

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[13] Moore's Law posits that the number of transistors on a chip doubles every two years, driving efficiency and performance improvements. Nvidia, however, has observed a faster rate of technological advancement with GPU performance increasing 317 times from 2012 to 2020, giving rise to "Huang's Law" (Mims, 2020).

[14] Personal communication, John Flansberg (Regional Infrastructure Manager, City of Reno) (August 2025).

[15] Personal communication, Adam Sullivan (Nevada State Engineer) (September 2025).

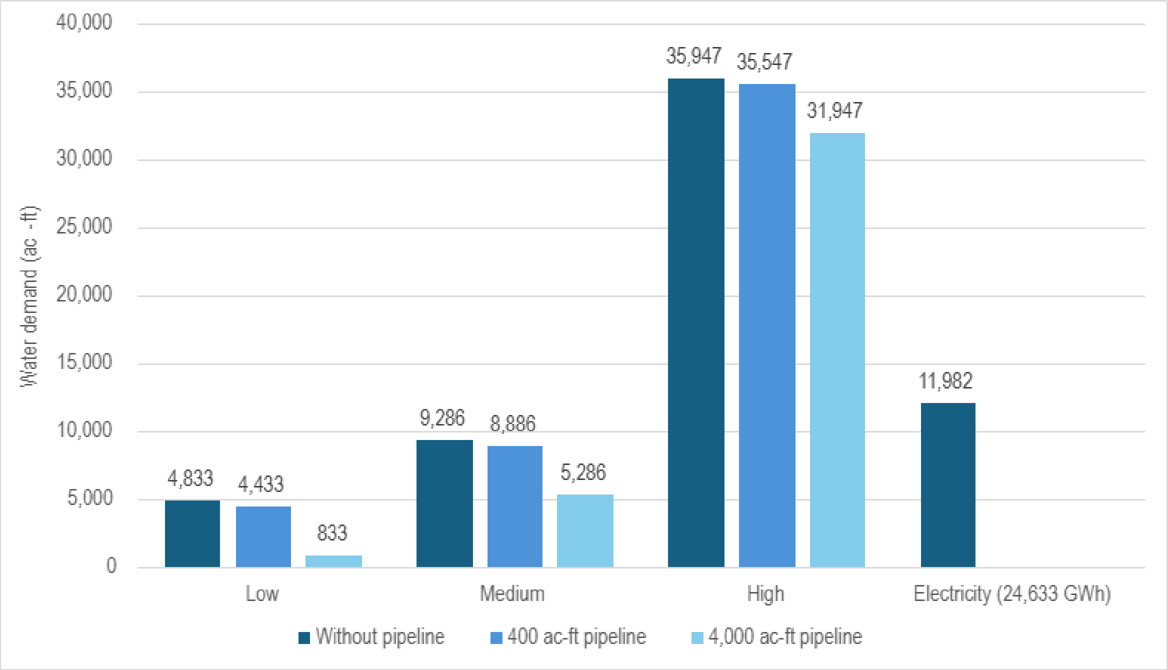

Figure 2. Cooling water demand (acre-feet) for Sierra Pacific Power for three different WUE values with and without supplemental water from the pipeline. Values are annual use following the eight-year buildout to the full projected load from NV Energy.

Under the most efficient scenario, the water needed annually for data center cooling within the Sierra service territory following the eight-year buildout amounts to 4,833 acre-feet. Under the least efficient scenario, a total of 35,947 acre-feet is needed annually. However, the amount of water that is ultimately consumed will depend on data center type, the cooling mechanisms in place, and other efficiency practices. Assuming the water needed for cooling — like the anticipated load growth — grows linearly over time, there is an implied need of 604 to 4,493 acre-feet for each year of the eight-year expansion period at Sierra. Significant portions of this demand can be satisfied by the pipeline water, although it depends on how much is available. Currently, only a small share of the pipeline's water is being used at TRIC, but not yet by data centers. It is probable, however, that data centers will put a larger share of the pipeline water to use during the eight-year buildout.[16] With respect to indirect water consumption, the water needed for electricity generation throughout the eight-year expansion totals 53,920 acre-feet (with 1,498 acre-feet being added during each year of the expansion, compounding over time). Once the buildout is complete, the indirect use of water, the amount of water required annually for the generation of 24,633 GWh, totals 11,982 acre-feet.

Table 2 sums the water needed for data center cooling and subtracts water provided by the pipeline to yield the following high-medium-low estimates of cooling water consumption over the eight-year expansion.

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[16] Personal communication, John Flansberg (Regional Infrastructure Administrator, City of Reno) (August 2025).

Table 2. Accumulation of Water Needed for Data Center Cooling Over the Eight-Year Expansion (ac-ft).

Scenario	NV Water Demand	Sierra Pacific Power Water Demand (without pipeline)	Sierra Pacific Power Water Demand (400 AFY pipeline)	Sierra Pacific Power Water Demand (4,000 AFY pipeline)
Low	22,593	21,749	18,549	-10,252
Medium	43,411	41,787	38,587	9,787
High	168,044	161,762	158,562	129,762

Summing the water needed for data center cooling indicates an additional need of 628 to 4,668 acre-feet for each year of the expansion throughout Nevada. Because demand compounds each year with the progression of the buildout, water demand sums to 22,593 to 168,044 acre-feet over the expansion period. Electricity generation drives indirect water consumption of 56,015 acre-feet throughout Nevada (with 53,920 acre-feet needed in Northern Nevada by Sierra Pacific Power). While the cooling water demands outlined in Table 2 are partially alleviated by the pipeline, it largely depends on how much of that water is usable. If an average of 400 acre-feet were utilized during each year of the buildout, more than 3,000 acre-feet could be saved at Sierra. If all 4,000 acre-feet per year could be utilized, then more than 30,000 acre-feet could be saved over the eight-year expansion at Sierra, creating an excess supply of about 10,252 acre-feet under the low WUE scenario. Most of the projected load growth (24,633 of 25,590 GWh) and water demand occurs in Sierra's service territory, and much of this demand is driven by TRIC. Remaining load growth (957 GWh) and water demand in Nevada Power's service territory, including the Apex Industrial Park, is not supported by the pipeline.

After the expansion period, the 25,590 GWh in load growth becomes part of the grid's new baseload, and the water required for data center cooling and electricity generation is needed annually. Table 3 estimates the water needed annually for data center cooling after the eight-year buildout.

After the eight-year buildout, annual water demand for data center cooling totals 5,021 to 37,343 acre-feet throughout Nevada. Most of this (4,833 acre-feet per year) occurs within Sierra's service territory while cooling needs at Nevada Power amount to approximately 188 AFY. As seen in Table 2, some of Sierra's demand may be alleviated by the pipeline, although 400 acre-feet is marginal compared to remaining demands. Being able to use all 4,000 acre-feet from the pipeline helps in further satisfying demand, but these savings entirely depend on the amount of water available from the pipeline.

Table 3. Water Needed Annually for Data Center Cooling After the Eight-Year Expansion (ac-ft).

Scenario	**NV Water Demand**	**Sierra Pacific Power Water Demand (without pipeline)**	**Sierra Pacific Power Water Demand (400 AFY pipeline)**	**Sierra Pacific Power Water Demand (4,000 AFY pipeline)**
Low	5,021	4,833	4,433	833
Medium	9,647	9,286	8,886	5,286
High	37,343	35,947	35,547	31,947

The scale of data center water demand can be substantial when compared to other water uses. Between Sierra and Nevada Power, a total of 5,021 to 37,343 acre-feet will be needed annually for data center cooling. Figure 3 compares annual data center cooling following the expansion under the low, medium, and high WUE scenarios to the average annual water use of ten-thousand households, an 18-hole golf course, and a 271-acre alfalfa farm.[17]

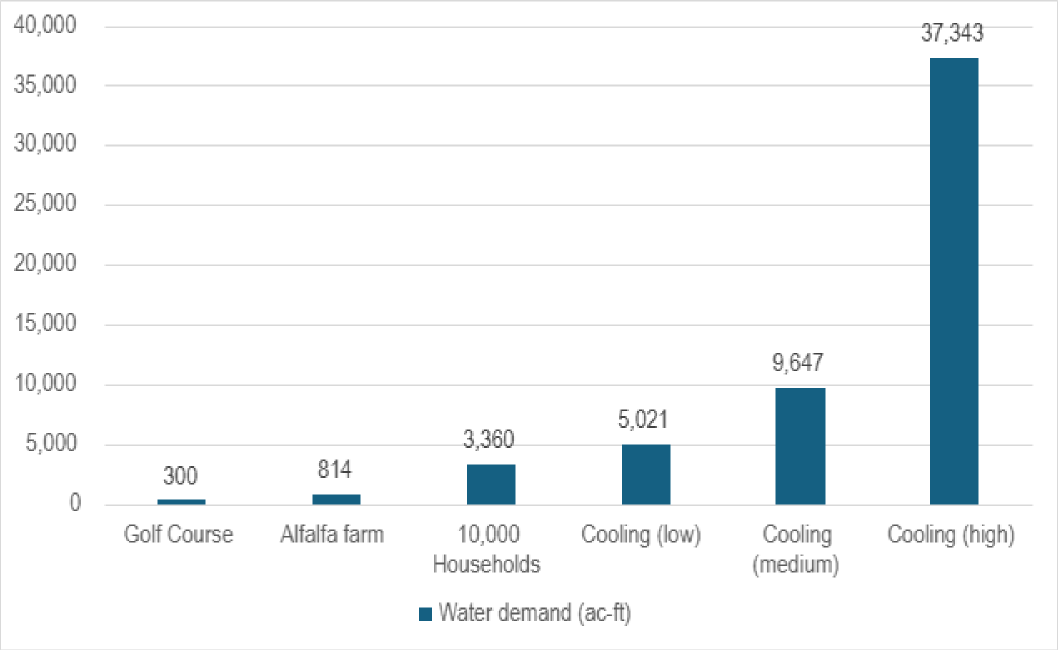

Figure 3. Annual data center cooling after the eight-year expansion period under the low, medium, and high WUE scenarios compared to the annual water use of ten-thousand households, a golf course, and an alfalfa farm.

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[17] Estimates of household, golf course, and alfalfa farm water use were derived from the EPA (2024), Lyman (2012), and USDA (2024), respectively. The EPA (2024) states that the average American household consumes at least 300 gallons of water per day (0.336 acre-feet in a year). According to the 2022 Census of Agriculture, the average size of an alfalfa farm in Nevada is 271.4 acres (USDA, 2024), and this analysis assumes that each farm is irrigated to a depth of three feet. Additionally, the USGA estimated that an average 18-hole golf course consumes approximately 300 AFY in the Upper West/Mountain agronomic region (Lyman, 2012).

Assuming the highest level of efficiency, the water needed annually for data center cooling under the projected load growth from NV Energy is more than 14,940 times the water needed for a single household, close to 17 times the water needed for an 18-hole golf course, and approximately six times the water needed for an alfalfa farm. Under the least efficient scenario, however, annual data center cooling water demand equates to the water consumption of about 111,140 households, 124 18-hole golf courses, or 46 alfalfa farms.

To further contextualize data center water demand as it relates to other water uses, Table 4 compares data center water demand to Nevada's total water withdrawals (AFY) by water-use category (Dieter *et al.*, 2015). Compared to industrial water withdrawals of approximately 6,400 AFY, Nevada's data center buildout represents a considerable expansion of water demand. The medium WUE scenario estimates about 9,647 AFY of data center water demand following the buildout, which is about 151 percent of the sector's total water withdrawals. However, compared to some other categories like irrigation, data center water demand appears insignificant. For example, water demand under the medium WUE scenario represents only 0.42 percent of total water withdrawals for irrigation. This suggests that data center water demand growth may have greater impacts on some industries than others. Additionally, this represents new data center water demand from the 12 projects forecasted by NV Energy and not all data center water demand in Nevada. For this reason, the impacts of total data center water use in Nevada could be more pronounced than what is reflected here.

Table 4. Data Center Water Demand as a Percentage of Total Water Withdrawals (AFY) by Water-use Category in Nevada.

	Public Supply	**Domestic**	**Irrigation**	**Livestock**	**Industrial**	**Mining**	**Thermoelectric Power**
Total withdrawals (AFY)	596,000	40,100	2,320,000	5,540	6,400	231,600	89,290
Cooling (low)	0.84%	12.52%	0.22%	90.63%	78.45%	2.17%	5.62%
Cooling (medium)	1.62%	24.06%	0.42%	174.13%	150.73%	4.17%	10.80%
Cooling (high)	6.27%	93.12%	1.61%	674.06%	583.48%	16.12%	41.82%
Electricity generation	2.09%	31.04%	0.54%	224.69%	194.50%	5.37%	13.94%

Data center water demand entails considerable costs. These costs will ultimately depend on how water is sourced and whether data centers purchase water rights or engage in water leasing. The first two years of Nevada's water buyback program priced water rights at $900 per acre-foot (Williams, 2025). However, the program has been prioritized in basins with water rights threatened with curtailment and may, for this reason, underestimate data center water costs.[18] Burns *et al*. (2022) showed that, for the period 2002 to 2019, median water right prices were $9,800/ac-ft in Nevada. Average prices were steeper, amounting to $14,610/ac-ft. Assuming the data center projects outlined by NV Energy purchased water rights at the median price at the beginning of the expansion, then the water needed for electricity generation (12,448 ac-ft) would cost approximately $122 million while the cost of water needed for cooling (5,021 to 37,343 ac-ft) would range between $49 million and $366 million following the eight-year expansion:

- Low: $49,201,571
- Medium: $94,540,208
- High: $365,962,097.

If data centers purchase water rights, then the above costs are paid once and the amount of water paid for is allotted each year. Instead, this analysis assumes that data centers engage in water leasing. These costs are lower, but they must be paid annually. Burns *et al*. (2022) estimated a leasing price of $60/AFY in Nevada. However, prices could be higher depending on the water source (surface water versus groundwater) and location. Additionally, both leasing and sale transaction prices have fluctuated over time and may increase due to a combination of rapid demand growth and tightening supply. Thus, this analysis assumes a price of $90/ac-ft per year. In applying this rate, the costs of data center cooling and anticipated load growth over the eight-year expansion are made clear in Table 5.

Table 5. Accumulated Cost of Water Needed for Data Center Cooling Over the Eight-Year Expansion ($ millions).

Scenario	NV Water Demand	Sierra Pacific Power Water Demand (without pipeline)	Sierra Pacific Power Water Demand (400 AFY pipeline)	Sierra Pacific Power Water Demand (4,000 AFY pipeline)
Low	$2.28	$2.20	$1.88	-$0.946
Medium	$4.39	$4.23	$3.91	$1.08
High	$16.99	$16.36	$16.04	$13.21

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[18] Personal communication, Adam Sullivan (Nevada State Engineer) (September 2025).

Like Table 2, the above costs compound after each year of the expansion as the water needed for data center cooling, and hence costs, scale. Ultimately, the cost of cooling throughout the eight-year expansion amounts to $2.28 to nearly $17 million. The bulk of these costs are borne within Sierra's service territory — primarily at TRIC — and may be partially reduced in using water from the pipeline. With 400 acre-feet per year available, costs may be reduced by about $320,000. With full use of the pipeline, costs may be reduced by more than $3 million. Water consumed indirectly through electricity generation drives additional costs. Throughout Nevada, the cost of the 56,015 acre-feet needed to generate 25,590 GWh over the eight-year expansion totals $5.66 million. Most of this additional cost is realized at Sierra. Approximately 53,920 acre-feet will be needed to generate 24,633 GWh over the expansion period, costing about $5.45 million.

When the expansion is completed, the 5,021 to 37,343 acre-feet of water needed annually for data center cooling (see Table 3) could entail considerable annual costs. Table 6 outlines these costs. The total annual cost of water for data center cooling ranges between $551,000 and $4.09 million. In addition to these costs are the costs of the water needed annually for electricity generation. This amounts to $1.31 million at Sierra and totals $1.36 million across the state. As also seen in Table 3, with the full use of the pipeline's 4,000 acre-feet, there is potential for considerable savings. Again, however, those savings hinge on the amount of water from the pipeline that is consistently usable over time. The use of 400 acre-feet per year is still important in helping reduce demand, saving almost $44,000 each year. However, if 4,000 acre-feet were available, then nearly $440,000 could be saved yearly. Ultimately, the range of cost is substantial, underscoring the cruciality of resource efficiency in the cooling and powering of data centers.

Table 6. Cost of Water Needed Annually for Data Center Cooling After the Eight-Year Expansion ($ millions).

Scenario	NV Water Demand	Sierra Pacific Power Water Demand (without pipeline)	Sierra Pacific Power Water Demand (400 AFY pipeline)	Sierra Pacific Power Water Demand (4,000 AFY pipeline)
Low	$0.551	$0.530	$0.486	$0.091
Medium	$1.06	$1.02	$0.974	$0.580
High	$4.09	$3.94	$3.90	$3.50

The potential cost of the eight-year expansion is also influenced by electricity prices. From January 2020 to May 2024, electricity prices for the industrial sector in the U.S. ranged from $0.0637/kWh to $0.0938/kWh. In Nevada, average electricity prices were $0.0687/kWh for the industrial sector and $0.1042/kWh for all sectors in 2024 (a decrease from

$0.0814/kWh and $0.1144/kWh for the industrial sector and all sectors, respectively, in 2023) (Energy Information Administration, 2025b; Statista Research Department, 2024). This analysis uses a price of $0.09/kWh. Thus, the 115,155 GWh generated throughout the eight-year expansion implies a cost exceeding $11.64 billion. Of this generation, approximately 110,849 GWh occurs at Sierra, costing more than $11.2 billion. Following the buildout, the annual cost of generating 25,590 GWh exceeds $2.8 billion.

Energy costs are also driven by groundwater pumping and water treatment, but to a lesser extent than the abovementioned load growth. As shown in Table 7,[19] groundwater pumping increases electricity consumption and associated costs, though it depends on how much of the water is obtained in this way. Following the buildout, pumping 50 percent of the water needed annually for electricity generation would consume more than 2,261 MWh, and costs could reach $248,000. Likewise, pumping half of the water needed annually for data center cooling could consume 2,370 to 17,630 MWh and cost between $260,000 and $1,933,000. While it is unclear whether these additional energy demands and costs are included in power purchase agreements (PPAs) or other energy contracts between data centers and NV Energy, they are important in understanding the full extent of data centers' direct and indirect energy uses and associated costs.

Table 7. Electricity Needs and Costs for Groundwater Pumping.

Water Use	Water Demand (AFY)	50% Pumped		100% Pumped	
		Electricity Needed (kWh)	Cost ($ millions)	Electricity Needed (kWh)	Cost ($ millions)
Electricity Generation	12,448	2,261,030	$0.248	4,522,061	$0.496
Cooling (Low)	5,021	2,370,150	$0.260	4,740,301	$0.520
Cooling (Medium)	9,647	4,554,214	$0.499	9,108,429	$0.999
Cooling (High)	37,343	17,629,217	$1.93	35,258,434	$3.87

If the TRIC pipeline is utilized to satisfy data center cooling needs, then treatment of the pipeline water may contribute to energy costs. Wakeel *et al.* (2016) found that the average water treatment plant in the U.S. consumed 0.45 kWh/m^3 of water. Soares *et al.* (2017) corroborated this finding, explaining that conventional water treatment systems consumed between

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[19] Groundwater pumping estimates assume the following: 1.02 kWh is needed to lift one acre-foot of water one foot; pumping pressure is 50 psi (and one psi equals 2.31 ft of lift); and the wire-to-water efficiency (i.e. how well a pump performs relative to electricity input) is 0.6 (Todd Engineers, 2014). The initial depth to water pumped for data center cooling is approximately 209 ft (based on average groundwater levels at TRIC) while the depth to water pumped for electricity generation is 98 ft (based on shallower groundwater levels at NV Energy's Frank A. Tracy Generating Station) (USGS, 2025). An additional 231 ft was added to the distance pumped since water at TRIC is pumped beyond ground-level into higher-elevation storage tanks.

0.3 and 0.6 kWh/m^3. Thus, assuming an average water treatment plant electricity use of 0.45 kWh/m^3 (about 555 kWh/ac-ft), the annual treatment of 400 acre-feet following the eight-year expansion could consume about 222 MWh and cost approximately $24,300. At 100 percent use (4,000 AFY), more than 2,220 MWh would be needed annually at a cost of more than $243,000.

Table 8 displays the total annual costs of data center cooling and electricity generation after the eight-year expansion under the medium WUE scenario. Groundwater pumping and water treatment costs are not included as it remains unclear how much of the water demand will be satisfied in each way. Additionally, GPU manufacturing is not included as those costs are most likely borne at the site of manufacturing. "Data Center Cooling" is the cost of water needed annually for data center cooling based on NV Energy's forecasted load growth; "Energy Load Growth (Water)" refers to the cost of water needed annually to generate 25,590 GWh; and "Energy Load Growth (Electricity)" is the estimated price of that generated electricity for ratepayers. While costs are stated as absolutes, they remain approximations based on the most current publicly available information. Uncertainties such as project completion rates, potential efficiency gains, and economic incertitude may introduce inaccuracy into analysis results.

Table 8. Annual Data Center Cooling and Electricity Generation Costs After the Eight-Year Expansion ($ millions).

Cost	**State**	**Sierra**	**Nevada Power**
Data Center Cooling	$1.06	$1.02	$0.040
Energy Load Growth (Water)	$1.36	$1.31	$0.051
Energy Load Growth (Electricity)	$2,806.10	$2,701.16	$104.94
Total	$2,808.53	$2,703.49	$105.03

The annual costs of data center cooling and electricity generation in Nevada following the eight-year expansion are significant. Annual cooling costs total nearly $1.06 million while the cost of water to generate NV Energy's projected load growth exceeds $1.36 million. Comparatively, electricity prices are much larger. Assuming a rate of $0.09/kWh, the cost of 25,590 GWh is more than 1,150 times the combined annual cost of water for cooling and electricity generation. Notably, most of these costs are attributable to load growth and water demand at Sierra. As previously discussed, 24,633 GWh of the projected 25,590 GWh is driven by data center projects in Sierra's service territory. TRIC, where much of this growth is concentrated, requested 3,820 MW of incremental capacity whereas Apex requested 390 MW (NV Energy, 2024b). As a result, annual costs exceed $2.703 billion at Sierra.

This can be broken down into Data Center Cooling ($1.02 million), Energy Load Growth (Water) ($1.31 million), and Energy Load Growth (Electricity) (about $2.701 billion). In contrast, total annual costs at Nevada Power are approximately $105 million. Table 9 displays results under each efficiency scenario for both the eight-year buildout and annually thereafter.

Table 9. Water, Electricity, and Costs for Data Center Expansion.

	Scenario	**State**	**Sierra**	**Nevada Power**
Expansion	Electricity need (GWh)	115,155	110,849	4,307
	Electricity cost ($ mil)	$11,643.41	$11,207.97	$435.43
	Water for generation (ac-ft)	56,015	53,920	2,095
	Water cost ($ mil)	$5.66	$5.45	$0.212
	Low (Cooling, ac-ft)	22,593	21,748	845
	Low (Cost, $ mil)	$2.28	$2.20	$0.085
	Medium (Cooling, ac-ft)	43,411	41,788	1,623
	Medium (Cost, $ mil)	$4.39	$4.23	$0.164
	High (Cooling, ac-ft)	168,044	161,759	6,284
	High (Cost, $ mil)	$16.99	$16.36	$0.635
Annual	Electricity need (GWh)	25,590	24,633	957
	Electricity cost ($ mil)	$2,806.10	$2,701.16	$104.94
	Water for generation (ac-ft)	12,448	11,982	466
	Water cost ($ mil)	$1.36	$1.31	$0.051
	Low (Cooling, ac-ft)	5,021	4,833	188
	Low (Cost, $ mil)	$0.551	$0.53	$0.021
	Medium (Cooling, ac-ft)	9,647	9,286	361
	Medium (Cost, $ mil)	$1.06	$1.02	$0.040
	High (Cooling, ac-ft)	37,343	35,947	1,397
	High (Cost, $ mil)	$4.09	$3.94	$0.153

Given NV Energy's considerable anticipated load growth and the energy intensity of data centers, electricity prices are critical in determining overall costs. Therefore, minor changes to electricity prices can significantly influence the resultant costs. To illustrate this point, each $0.01/kWh corresponds to nearly $311.8 million in annual electricity costs following the eight-year expansion period (or today about $255.9 million, nominally). This is an important consideration given the potential for data center expansion in Nevada to exacerbate grid stress and exert upward pressure on energy rates (Thompson *et al.*, 2024; Lee *et al.*, 2025; Young, 2025a).

Changes to the amount of electricity needed can also impact the resulting costs. At the rate of $0.09/kWh, each GWh is worth $109,656 after the expansion period (or $90,000 nominally). Furthermore, the generation of each GWh requires about 0.486 acre-feet of water (worth $53.34 after the expansion or $43.78 nominally). For these reasons, a data center's power usage effectiveness (PUE) — a measure of how efficiently a facility uses energy — is important in shaping not only total costs but also indirect water consumption, which is not included in a data center's WUE. Since water is indirectly consumed through electricity generation, the more efficient use of that electricity translates to more efficient water use. Additionally, as indicated in this and other analyses, electricity generation represents the largest share of a data center's water footprint (Mytton, 2021). The role of energy efficiency in reducing water demand is pertinent to Nevada given its relative scarcity of water as the driest state in the U.S.

Efforts are already underway to reduce the stress data centers may place on local grids by increasing load flexibility. Increasing the flexibility of AI workloads alongside supply-side investments may enable continued data center expansion while reducing the need for capital-intensive expenditures on new generation capacity (Norris *et al.*, 2025). In examining 22 of the U.S. electrical power system's balancing authorities, Norris *et al.* (2025) estimated that 76 to 215 GW of new load could be integrated into the U.S. power system provided that some percentage of this load be curtailed during the highest load hours. Specifically, 76 GW could be added at a curtailment rate of 0.25 percent; 98 GW at a rate of 0.5 percent; 126 GW at a rate of 1 percent; and 215 GW at a rate of 5 percent (Norris *et al.*, 2025).[20] The greater efficiency realized through load flexibility has the potential to not only save energy but also water resources that may otherwise be used to generate electricity. Given NV Energy's water consumption factor for electricity generation (0.6 L/kWh) and the above energy savings, there is an implied water savings of 37 to 105 acre-feet per hour of curtailment. Additionally, assuming a price of $90/AFY, then between $4,054 and $11,468 (or between $3,327 and $9,412, nominally) of water costs may be saved or reallocated annually following the expansion. The opportunities presented by data center load flexibility were made clear in a demonstration by Emerald AI in Phoenix, Arizona. The startup ran various AI workloads on a 256-GPU cluster and was able to achieve a 25 percent reduction in energy consumption for three hours while maintaining AI quality of

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[20] The curtailment rate may be understood as the maximum potential annual energy consumption of the new load that would be curtailed during the highest load hours (e.g. 1/400 GWh for a rate of 0.25%) (Norris *et al.*, 2025).

service. Moving forward, increasing data center flexibility may accelerate interconnection while reducing the need for expensive infrastructure upgrades. However, as uncertainties remain, larger-scale deployments are needed to validate these control and coordination strategies (Colangelo *et al*., 2025).

Notably, how water is sourced also influences resulting prices. As previously mentioned, the average water treatment plant in the U.S. requires 0.45 kWh/m^3 (555 kWh/ac-ft). At the rate of \$0.09/kWh, there is an implied cost of approximately \$61/ac-ft of treated wastewater (\$50/ac-ft nominally). Although this is significantly less than the \$90/AFY for water leasing, it does not account for the capital needed to build a water treatment plant. At 10 percent utilization (400 AFY), treating water from the TRIC pipeline amounts to about \$24,300 per year (nearly \$243,000 per year for the full 4,000 acre-feet). If a larger share of this water could be used to support data center expansion in Nevada, it could help in substantially lowering both water needs and costs.

CONCLUSION

The emergence of Nevada as a data center hotspot presents an opportunity for the state to position itself as a central player in the growing digital world. This opportunity, however, also presents the challenge of balancing the energy- and water-intensity of data centers with the needs of other stakeholders. The generation of 25,590 GWh throughout the eight-year buildout will require approximately 56,015 acre-feet of water (with 1,556 acre-feet being added each year). Electricity demand compounds to 115,155 GWh over the eight-year expansion. Likewise, the water needed for data center cooling during the eight-year expansion totals between 22,593 and 168,044 acre-feet (with 628 to 4,668 acre-feet being added each year). Following the buildout's completion, water for cooling and electricity generation will be needed annually. Generating 25,590 GWh will require about 12,448 acre-feet annually. For data center cooling, this implies an annual need of 5,021 to 37,343 acre-feet. GPU manufacturing may require an additional 8.16 acre-feet. Finally, while some of these demands may be satisfied by treated wastewater, it remains unclear how much will be usable for these data center projects.

Challenges including the state's aridity and the potential for loss-of-load hours in an increasingly stressed grid must be carefully navigated alongside the socioeconomic implications of growing resource scarcity. Numerous uncertainties remain, complicating efforts to navigate these challenges. Advancements in cooling technology and AI create new opportunities for resource- and capital-efficiency, though increased use may still drive overall consumption (IEA, 2025; Bothwell and Walsh, 2025; Li *et al*., 2023). Future work may therefore seek to clarify the potential benefits of increasing load flexibility and emerging cooling technologies.

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