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DATA CENTER IMPACTS IN THE WEST

Policy Solutions for Water and Energy Use

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Data Center Impacts in the West: Policy Solutions for Water and Energy Use

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A data center in Leesburg, Virginia.

Executive Summary

Data centers pose a myriad of challenges for policymakers. Significantly expanded demands for electricity threaten electric utilities' ability to reduce the greenhouse gas pollution that causes climate change; water demands for cooling may strain scarce water supplies; and new costs and economic risks may be imposed on other electric customers.

Projected electricity demand — or **load growth** — associated with data centers has appeared virtually overnight primarily due to the recent proliferation of artificial intelligence. All of these factors present a challenge for meeting clean energy and water conservation goals. In this report, Western Resource Advocates (WRA) describes the problem and suggests policies for mitigating these impacts and harnessing data centers as a tool for clean energy development.

Over just the past few years, seven of the eight largest utilities in the Interior West, located in Arizona, Colorado, Nevada, New Mexico, and Utah — where WRA works to decarbonize the power sector — have seen collective **load forecasts** increased significantly, largely due to the projected electricity demands of data centers. From 2010 through 2023, total annual electricity sales grew by approximately 1% per year.[1] Now, **the utilities are collectively forecasting an increase in annual energy demand of about 4.5% per year between 2025 and 2035. A similar trend is true for peak energy demands, exacerbating grid stress.** These higher load forecasts are driving

[1] Calculated from US Energy Information Administration, "EIA-861 Annual Electric Power Industry Report," October 2024. **https://www.eia.gov/electricity/data/state/**

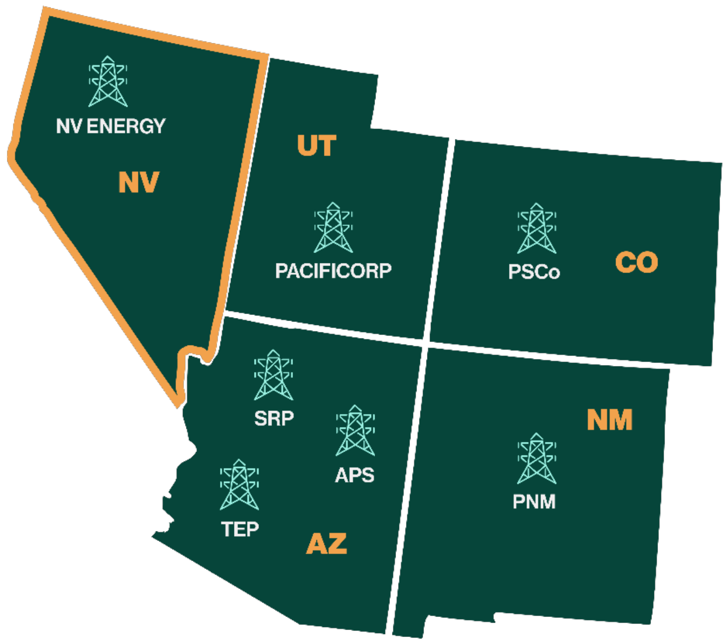
increased greenhouse gas emissions for utilities. One telling example is NV Energy, whose projected emissions in its 2024 **Integrated Resource Plan** (IRP) jumped 53% from its 2022 estimates.[2] This amounts to 3.2 million tons of additional greenhouse gas pollution.[3]

53% increase in greenhouse gas emissions

from 2022 IRP estimates.

3.2M additional tons

of greenhouse gas polllution.



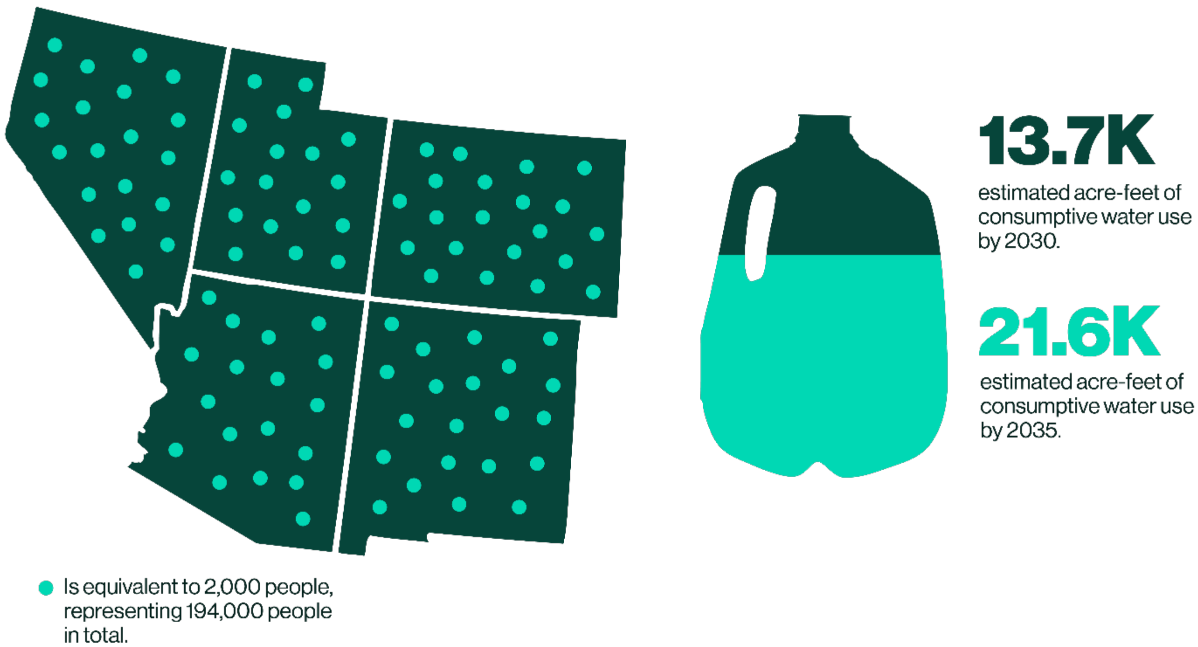
In addition to the energy demands, many data centers use large volumes of water to cool and protect the computer hardware they contain. If utility predictions on data center growth come to fruition, data centers in the five states noted above could have annual, on-site consumptive water use of 13,700 **acre-feet** (4.5 billion gallons) in 2030, and 21,600 acre-feet (7 billion gallons) in 2035, assuming they use conventional water-based cooling technologies.[4] For comparison, 21,600 acre-feet is enough

[2] Based on a comparison of NV Energy's projected fuel mixes and CO_2 emissions from the preferred Repower Minimum case in Public Utilities Commission of Nevada Docket No. 23-08015 and preferred Balanced case in Public Utilities Commission of Nevada Docket No. 24-05041. For 2030, the Balanced case projects 2030 CO^2 emissions at 8.41 million metric tons, versus 5.48 million metric tons projected for the same year under the prior Repower Minimum case - an increase of 2.93 million metric tons, or 3.2 million short tons. A comparison of the 2030 fuel mix projections from the two dockets shows similar amounts of renewable generation (21,752 GWh for Repower Minimum versus 21,676 GWh for Balanced), but a big increase in the amount of natural gas generation (10,455 GWh Repower Minimum versus 17,642 GWh Balanced) under the new load forecast.

[3] Estimated change in emissions between the 2024 IRP Balanced Plan (Public Utilities Commission of Nevada Docket No. 24-05041), and the Fifth Amendment to the 2021 IRP (Public Utilities Commission of Nevada Docket No. 23-08015).

[4] Using an estimate of the national average onsite water intensity of data centers of 0.36 L/kWh (equal to 95 gallons/MWh) and the electric utilities' energy demand projections, we estimate the incremental, additional water demands associated with cooling data centers in the five-state region could be 13,700 acre-feet per year in 2030 and 21,600 acre-feet per year in 2035.

water to support 194,000 people per year.[5] In the arid Interior West, where water supplies are already scarce, and becoming more so, this level of increased demand poses unique risks and challenges.



While data centers pose an emerging threat, the adoption of smart policies can reduce the impacts. Major data center companies — Google, Meta, Amazon, and others — have expansive financial resources, and many have company climate and clean energy goals. If these sources of new electricity prioritize corporate responsibility and sustainability commitments, they could help accelerate the clean energy transition and minimize use of scarce water resources. To address the emerging challenges and drive positive outcomes, WRA recommends that utilities, regulators, and elected leaders evaluate and adopt policies that advance clean energy, protect electricity customers, and minimize and mitigate impacts on water resources.

WRA's potential policies are summarized in this Executive Summary and explored in depth in the report.

[5] Water Education Foundation, "Acre-Foot." **https://www.watereducation.org/aquapedia/acre-foot**

Wind turbines and battery storage at a power plant in Palm Springs, California.

Advancing Clean Energy: Create Clean Transition Tariffs

Clean transition tariffs can enable new data center customers to develop and finance clean energy resources like solar with battery storage and wind. Under a clean transition tariff, a utility may develop new, clean resources on behalf of its data center customers, and the data center pays any incremental additional cost of the clean resource, without impacting other utility customers. Regulators must determine which resources are eligible under a clean transition tariff and ensure that other customers are paying their full share of the costs.

Advancing Clean Energy: Deploy Behind-the-Meter Clean Resources

Allowing data centers to invest in **behind-the-meter clean resources** can help decarbonize the grid. With behind-the-meter resources, the data center develops, owns, and operates the clean energy resource directly. Data centers should be limited to deploying clean resources and not behind-the-meter gas or diesel generators, which emit harmful greenhouse gas pollution and degrade local air quality. A behind-the-meter program could also allow data centers to develop behind-the-meter **energy storage** systems.

Advancing Clean Energy: Encourage Load Shifting

Data centers are generally **high load factor** customers — their demand for electricity is relatively constant from hour to hour and day to day. However, certain types of data centers may be able to participate in **demand response** programs, shifting their electricity consumption away from times of peak electricity demand, thereby reducing costs and strain on the broader grid. Utilities can encourage this behavior by crafting load **interconnection** standards or **tariffs** with provisions that allow for **load interruption**, in exchange for faster interconnection.

Advancing Clean Energy: Require Energy Efficiency Best Practices

Decision makers should establish efficiency-related requirements for interconnecting new data centers, like employing energy efficiency best practices, and reducing the total energy consumption of data centers.

Protecting Electricity Customers: Reform Resource Planning and Acquisitions

The explosion of projected data center electricity needs has injected massive uncertainty into utilities' near- and long-term load growth projections in a very short period of time, straining their ability to accurately forecast future system needs. If utilities overbuild transmission, generation, or **distribution infrastructure**, then residential and commercial customers could be left on the hook, forced to pay for capital investments that turn out to be unnecessary. To improve load forecasts, utility regulators should establish best practices and requirements for utility load forecasting. Regulators should also consider revamping their Integrated Resource Planning (IRP) processes to better accommodate the rapid and uncertain nature of data center growth.

Protecting Electricity Customers: Establish Contract Provisions to Prevent **Cross-Subsidies**

Projections indicate that data centers are a vast source of new electricity load, potentially requiring significant utility investments in generation and transmission. If data center loads do not materialize, or do not remain on the system for as many years as forecasted, remaining customers are likely to bear the financial costs of capital investments that become **stranded assets**. It is critical that utilities develop robust contract provisions for data centers that will protect other customers from having to subsidize them. Such provisions could include minimum contract lengths and exit penalties for new large load customers, financial collateral requirements, and minimum demand payments to ensure data centers are contributing to the costs of the overall system.

A person adjusts a smart thermostat.

Protecting Electricity Customers: Follow Best Practices in Ratemaking

The impact of sudden large concentrated new loads that require massive amounts of new energy and capacity investments poses a challenge to the status quo of ratemaking. The magnitude and characteristics of data center loads require updates and tailored considerations within the ratemaking process to ensure new large customers are paying their fair share through the regulatory process known as **cost allocation**. This could include creating a new **rate class** for these types of customers, given their unique attributes and system impacts. Issues such as generation and transmission capacity needs, **power quality** investments, contribution to peak capacity, and others need to be addressed specifically for data centers. The regulatory processes must adapt to protect customers.

Protecting Electricity Customers: Restructure Economic Development Rates

Currently, data centers often receive incentives in the form of reduced electricity rates, sometimes referred to as **economic development rates**. Historically, these rates were designed to attract new large industrial or manufacturing facilities with high electricity demands that supported a sizeable new workforce and contributed significantly to the local tax base. WRA recommends that states and utilities structure new or reform existing economic development rates in a way that targets customers whose loads support significant, permanent employment. WRA believes this will make many data centers ineligible for economic development rates. Economic development rates should be available to data centers only if the utility can demonstrate that the rates provide a clear benefit to other utility customers and do not shift costs between customer classes, and that the data center will be powered with clean, zero-carbon electricity.

Protecting Water Resources: Water Efficiency and Reporting Requirements

Water use in data centers can vary significantly depending on the cooling system employed. In addition, there are clear trade-offs between energy use and water use. Water-cooled data centers generally use less energy, while data centers that employ water-efficient dry-cooling systems have higher energy demands. Given these trade-offs, the type of cooling system should be evaluated and selected on a case-by-case basis.

At a minimum, water used by data centers should not harm sensitive streams or habitat. If a data center's projected water demands would require tapping local surface or **groundwater** resources, and that water use could adversely impact valuable streams and habitats, it should be required to install water-efficient cooling systems such as dry-cooling or liquid-cooling technologies (other than water). Data centers in the Interior West region should also minimize their water demands through efficiency measures and water reuse. Local jurisdictions can require data centers to offset their water use by investing in local conservation programs.

Finally, the lack of comprehensive information on cooling systems and water use by data centers today presents a critical informational gap. Decision makers should address this by instituting reporting requirements.

A stream flows in the San Juan Mountains.

I. Introduction

Over the last two decades, data centers have powered our computing demands; their slow and steady growth has been largely incorporated in utility forecasts with little fanfare. But with the rise of artificial intelligence, there has been an explosion in demand for data centers; this drives extraordinary demands for energy to serve them. The energy demands of data centers, if not met with clean energy resources like solar and wind, will increase greenhouse gas emissions from the power sector, making it nearly impossible to prevent the most catastrophic impacts of climate change. In addition, investments in new energy generation and **transmission resources** place significant risks on customers. Managing those risks requires careful oversight and strong guardrails to protect other utility customers, especially residential customers. The additional water demands from data centers, while more variable, are still new water demands, placing strain on already scarce and over-allocated Western water supplies. Utilities, regulators, legislators, and other stakeholders are on a crash course to understand the risks, benefits, and key strategies to manage the policy implications of data center growth.

Without the guidance of reasonable policies, data centers pose an imminent threat to meeting climate and water conservation goals in the West. With the right policies in place, however, these emerging loads — along with the vast financial resources associated with them — can be part of the solution, further accelerating the transition to clean energy. Robust regulatory policies can protect customers, ensure that water resources are conserved, and spur investment in clean, innovative technologies. This paper presents a summary of the electricity load forecast for data centers in Western Resource Advocates' region along with the potential water impacts. Data centers may pose a range of other issues, such as siting and noise impacts, which are not addressed here. This report does not provide a comprehensive assessment of policies, but rather a suite of broad policy concepts that can address energy, water, and customer concerns. WRA is continuing to evaluate and develop model policies to address this emerging new industry.

Data Centers Threaten Efforts to Address Climate Change

In recent decades, electricity demand in Western states has remained relatively flat, and utilities have replaced aging, expensive fossil-fuel plants with clean, cost-effective renewable energy. The emerging data center and manufacturing boom, however, is poised to drive significant new load growth. If this massive projected increase in demand for electricity materializes and is not met with clean resources, then meeting the science-based emissions reductions necessary to limit warming to 1.5ºC to 2ºC and avoid the most damaging impacts of climate change will become immensely challenging, potentially infeasible.

> Limiting warming to 1.5ºC to 2ºC requires deep, near-term emissions reductions, including reducing economywide emissions roughly 50% below 2005 levels by 2030.

Rapidly decarbonizing the electricity sector is a key component of meeting these emissions reductions. A recent meta-analysis of modeling studies found broad modeling consensus that to meet the economywide goal, power sector emissions must be reduced by at least 77%. [6]

Western electric utilities and states have adopted emissions reductions goals or requirements. For example, in Colorado, Xcel Energy and Tri-State Generation and Transmission must reduce emissions associated with their Colorado load by at least 80% below 2005 levels by 2030, [7] and in New Mexico, Public Service Company of New Mexico (PNM) must meet an emissions rate standard of 200 pounds/MWh by 2032. [8] These policies provide a guardrail against significant emissions increases due to new load growth, so long as regulators enforce and uphold these policies. But in other Western states, as described in detail in Section II, load growth from data centers is threatening to delay emissions reductions.

Data Center Loads Differ from Beneficial Electrification Loads

Utilities are poised to see load growth from data centers alongside the electrification of transportation, buildings, and industry. Electrifying transportation, buildings, and industry is often characterized as beneficial electrification. Transitioning from gasoline, diesel, or natural gas to electricity reduces economywide greenhouse gas emissions; many beneficial electrification loads are flexible and can help integrate renewable resources. In addition, new loads that utilize existing infrastructure more efficiently, like increasing demand at off-peak times, can put downward pressure on electricity rates for all customers. Unlike large, concentrated data center loads, beneficial electrification load is generally dispersed and has a more gradual and predictable growth pattern. While data centers have sometimes been described as beneficial electrification, they differ in key ways from electrification of buildings, transportation, and industry. WRA disagrees with any characterization of data center load growth as beneficial electrification.

First, **beneficial electrification loads generally shift energy demands from fossil fuels to electricity, providing net emissions benefits.** Today, in all but the most coal-intensive utility service areas, electric vehicles [9] (EVs) and heat pumps [10] have lower net emissions than the equivalent fossil-fuel appliances. As the grid becomes cleaner, the net emissions benefits of EVs and heat pumps will increase.

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[6] Science, "Actions for reducing US emissions at least 50% by 2030.Science 376,922-924(2022)," John Bistline et al., May 2022. **https://www.science.org/doi/10.1126/science.abn0661**

[7] Colorado Revised Statutes § 40-2-125.5(3)(a)(I).

[8] New Mexico Energy Transition Act, New Mexico Statutes Annotated 1978, Section 62-18-10(D) (2019).

[9] Union of Concerned Scientists, "Driving Cleaner," July 2022. **https://www.ucs.org/resources/driving-cleaner**

[10] IOP Science, "US residential heat pumps: the private economic potential and its emissions, health, and grid impacts," March 2021; Thomas A Deetjen, Liam Walsh, and Parsh Vaishnav, et al 2021 Environ. Res. Lett. **https://iopscience.iop.org/article/10.1088/1748-9326/ac10dc/pdf**

Second, historically, demands for data centers are relatively inflexible. Data centers are often high load factor customers,[11] and while they may participate in emergency demand response events,[12] they typically do not shift load on a daily basis to enable greater integration of renewable energy or reduce **peak demands**. In contrast, EVs can charge during periods when renewable energy is high or would otherwise be curtailed. Utilities continue to optimize EV load with **time-of-use rates** and **managed charging** programs. Building electrification technologies, like heat pumps and electric water heaters, can be managed to integrate additional renewables or avoid peak demand periods and can provide demand response.[13]

A transmission tower stands under a clear blue sky.

[11] Energy and Environmental Economics, "Load Growth Is Here to Stay, but Are Data Centers?" 2024, page 20. **https://www.ethree.com/wp-content/uploads/2024/07/E3-White-Paper-2024-Load-Growth-Is-Here-to-Stay-but-Are-Data-Centers-2.pdf**

[12] See Public Utilities Commission of Ohio Case No. 24-508-EL-ATA; Revised Tariff Pages, PUCO No. 21, Schedule DCT, filed July 11, 2025. **https://dis.puc.state.oh.us/ViewImage.aspx?CMID=A1001001A25G11B21315A00184**

[13] Department of Energy, See, e.g., "Heat Pump Water Heaters Achieve Significant Peak Reduction and Energy Savings," 2019. **https://www.energy.gov/eere/buildings/articles/heat-pump-water-heaters-achieve-significant-peak-reduction-and-energy**

Third, if not managed, data center loads are likely to contribute significantly to rising peak demands on the broader grid. Currently, most Western utilities' loads peak in the summer due to air conditioning. Data centers, where an estimated 40% of electricity demand is for cooling,[14] are likely to exacerbate summer energy peaks if they do not participate in **load shifting** programs. In contrast, most EV charging can be shifted to off-peak periods, and increased deployment of heat pumps will contribute to winter peak demands, not summer peaks.[15] Beneficial electrification generally increases loads in off-peak periods, can be managed to correspond to available excess renewable energy production, and enables the utility to sell more electricity without investing in new capacity to meet peak demands. As a result, beneficial electrification allows the utility to utilize the existing generation and transmission infrastructure more efficiently and does not drive up capital costs associated with adding new peaking capacity. While some **hyperscale** data centers are piloting programs to shift load across grids based on cost and emissions,[16] data centers do not currently offer the same level of load flexibility as beneficial electrification.[17] Because data centers drive the need for additional peak capacity, their loads do not put downward pressure on rates.

Data Centers Tap Scarce Water Supplies

New data centers can also have significant water demands, potentially placing further strain on scarce water supplies in the arid West. Data center servers require cooling. Specific cooling needs vary depending on a number of factors, including the climate, where the data center is located, features like airflow efficiency, and operating parameters like temperature and humidity. Data centers can employ various cooling technologies and combinations of technologies, which generally fall into four different categories: **refrigeration cooling**, **adiabatic cooling**, **free-cooling**, and **liquid cooling**.

- **Refrigeration cooling system:** An air handler that circulates cool air in the data center and removes hot air; the hot air is then cooled in a compressor unit using air (an air-cooled chiller, also referred to in this report as **dry cooling**) or water (a water-cooled chiller).

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[14] McKinsey & Company, "Investing in the Rising Data Center Economy," January 2023. **https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/investing-in-the-rising-data-center-economy**

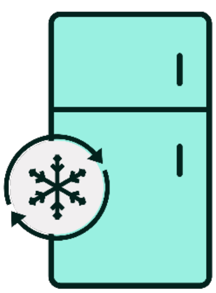
[15] Even under aggressive building electrification scenarios, Western electric utility systems are not projected to shift to winter-peaking for a number of years; however, it is critical that building electrification be paired with weatherization in order to minimize the need for electric resistance heating and the impact on winter peak demands. See Colorado Public Utilities Commission Proceeding No. 24AL-0275E Hearing Exhibit 101, Answer Testimony of Melissa Whited pgs. 12-13, 18 (filed October 11, 2024).

[16] Google; see, e.g., "Supporting power grids with demand response at Google data centers," October 2023. **https://cloud.google.com/blog/products/infrastructure/using-demand-response-to-reduce-data-center-power-consumption**

[17] The U.S. DOE's Secretary of Energy Advisory Board Working Group on Powering AI and Data Center Infrastructure recommended exploring "opportunities for temporal and spatial flexibility in AI training and inference" to mitigate peak demands. U.S. DOE, "Recommendations on Powering Artificial Intelligence and Data Center Infrastructure," July 2024. **https://www.energy.gov/sites/default/files/202408/Powering%20AI%20and%20Data%20Center%20Infrastructure%20Recommendations%20July%202024.pdf**

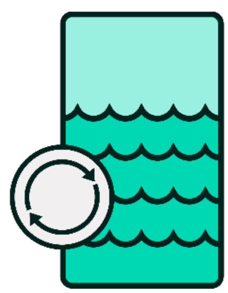
– **Air-cooled chillers** are typically more energy-intensive but consume no water.
– **Water-cooled chillers**, which may utilize a cooling tower, use less energy but are much more water-intensive. Water-cooled chillers that use a cooling tower are generally the most water-intensive form of cooling system used by data centers.

- **Adiabatic- or direct-evaporative-cooling system:** A cooling system that uses water to cool air that is circulated in the data center. For example, water may be sprayed to precool air circulated in the data center, or air used in the refrigeration compressor unit. Adiabatic cooling systems are similar to swamp coolers found in residential and commercial buildings, and work well in dry climates, but not in humid climates.
- **Free-cooling system:** A cooling system that takes advantage of outdoor ambient air or water temperatures to cool the air that is circulated in a data center. An air-side **economizer** can circulate outdoor air in the data center during the times of the day or year when the ambient humidity and temperature is low. Similarly, a water-side economizer may use a river, lake, or ocean to cool air that is used in a refrigeration system compressor or circulated through the data center. **Free-cooling** systems can reduce the overall energy needed to cool a data center.
- **Liquid-cooling system:** A system that directly absorbs heat from computer components, rather than cooling the air around computers. Liquid-cooling systems may immerse computer equipment in a fluid, such as water, glycol, or specialized coolants, and are more efficient than air at transferring heat from servers, enabling a higher temperature set point for the data center. This makes the data center more energy- and water-efficient. Liquid cooling is well suited to energy-dense technological equipment; while it is an emerging technology, it is increasingly being used by AI data centers.[18]

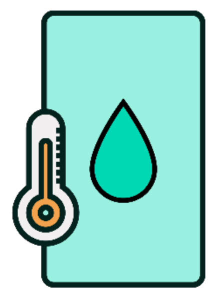


Refrigeration cooling systems use an air handler, circulate either cool air or water in the data center, and remove hot air.

Adiabatic- or direct-evaporative-cooling systems use water to cool air that is circulated in the data center.



Free-cooling systems take advantage of outdoor ambient air or water temperatures to cool the air that is circulated in a data center.



Liquid-cooling systems directly absorb heat from computer components, rather than cooling the air around the computers.

[18] Lawrence Berkeley National Laboratory, "2024 United States Data Center Energy Usage Report," Shehabi, A., Smith, S.J., Hubbard, A., Newkirk, A., Lei, N., Siddik, M.A.B., Holecek, B., Koomey, J., Masanet, E., Sartor, December 2024. **https://escholarship.org/uc/item/32d6m0d1**

These cooling technologies are often used in tandem. For example, a refrigeration system may also have an air-side economizer (a free-cooling system) that is deployed during ideal climate conditions to save energy.

Energy and water efficiency at data centers are measured using two metrics: **power use efficiency** (PUE) and **water use efficiency** (WUE). The PUE is the ratio of the energy used by the data center to the energy used for computing (measured in **kilowatt hour**/kWh). If the PUE is 1, the data center is perfectly efficient — all the energy is used for computing tasks. Higher PUEs indicate lower efficiency, because more energy is used for auxiliary tasks like cooling, lighting, or other on-site processes. WUE is measured as the liters of water per kWh of energy used for computing. Higher WUEs reflect lower efficiency. The water use efficiency can be further broken down into the water used on-site for cooling, and the water used off-site to generate electricity used by the data center. For the purposes of this analysis, WRA primarily focuses on the water used on-site.

In most cases, there are clear trade-offs between water efficiency and energy efficiency in data centers. A data center that relies entirely on dry cooling, such as an air-cooled chiller or refrigerated cooling, will have higher overall energy demands than a data center that employs a wet-cooling system, like refrigerated cooling with a cooling tower. This is particularly true in the summer. However, the air-cooled chiller has no water demands, while the water-cooled chiller can have substantial water requirements.

Based on modeling, one comprehensive analysis of data centers in the U.S. estimated the national average PUE was 1.4 in 2023.[19] According to the same analysis, the modeled on-site WUE — based on the mix of different types of data centers, cooling technologies, and climates — was estimated at 0.36 liters/kWh (L/kWh) in 2023.[20] Hyperscale and AI data centers are modeled to have lower PUEs, at 1.22 and 1.14, respectively, which reflects their use of more energy-efficient cooling systems.[21] However, these more energy-efficient cooling systems have higher water use and are less water-efficient. As a result, the on-site WUE of data centers is projected to rise — becoming less efficient— as the prevalence of hyperscale and AI data centers increases.[22]

While national estimates and trends are valuable, they may mask the impact in a local region. In a hot, arid location such as Central Arizona, cooling needs will be higher than if the same data center were in the temperate Pacific Northwest. In addition, the magnitude of the trade-offs between energy use and water use depends on the specific location and climate. In a Central Arizona study, researchers compared the WUE and PUE of two data centers: one that employed an air/dry-cooling system, and one that used a hybrid wet/dry-cooling system. The analysis found that the dry-cooled data center had an average annual PUE of 1.84, and an average annual on-site[23] WUE of approximately 0.11 L/kWh. The

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[19] Lawrence Berkeley National Laboratory, "2024 United States Data Center Energy Usage Report," Shehabi, A., Smith, S.J., Hubbard, A., Newkirk, A., Lei, N., Siddik, M.A.B., Holecek, B., Koomey, J., Masanet, E., Sartor, December 2024.
https://escholarship.org/uc/item/32d6m0d1https://escholarship.org/uc/item/32d6m0d1
[20] *Id.*
[21] *Id.*
[22] *Id.*
[23] As noted previously, this analysis focuses on the onsite water use of data centers; however, dry-cooled data centers have higher energy use, which may translate into higher water use off site, at power generation stations. These estimates do not include that off-site water use.

hybrid wet/dry-cooled data center had a PUE of 1.63 and an on-site WUE of 6.47 L/kWh.[24] The seasonal pattern of energy used at dry-cooled data centers is also relevant: the dry-cooled data center's PUE was roughly 16% higher (less efficient) in the summer months, while the hybrid-cooled data center's PUE did not vary considerably throughout the year. The dry-cooled data center used approximately 13% more energy throughout the year and had higher energy use in summer months — when other customers' demands also peak — but eliminated water use.[25]

Motorists travel on Interstate 10 in Phoenix, Arizona.

[24] Science Direct, "Water-energy tradeoffs in data centers: A case study in hot-arid climates," Karimi, L., L. Yacuel, J. Degraft-Johnson, J. Ashby, M. Green, M. Renner, A. Bergman, R. Norwood, and K. Hickenbottom, June 2021. **https://www.sciencedirect.com/science/article/abs/pii/S0921344922000428**

[25] *Id.*

WRA is working to understand the extent of current and projected water demands associated with data centers in our region. As of 2020, data centers nationwide were estimated to use over 500,000 acre-feet per year, [26] a usage that has almost certainly grown since then. For reference, 1 acre-foot is equal to approximately 326,000 gallons of water and is enough to provide water for approximately six to nine people for a year. [27] Nevada's allocation from the Colorado River is 300,000 acre-feet per year, which provides enough water for 2.3 million people — slightly more than the population of the Las Vegas metropolitan area. [28]

If the electric utilities' projections of data center load growth come to fruition, data centers in Nevada, Colorado, New Mexico, Arizona, and Utah could have annual, on-site consumptive water use of 13,700 acre-feet (4.5 billion gallons) in 2030, and 21,600 acre-feet (7 billion gallons) in 2035, assuming they use conventional water-based cooling technologies, and not including the water used to generate the electricity consumed by these facilities. If the projected data centers are powered with combined-cycle gas plants, either on-site or off-site, the consumptive water footprint could total as much as 56,700 acre-feet (18.5 billion gallons) in 2030 and 89,700 acre-feet (29.2 billion gallons) in 2035.

More recently, some companies have been able to reduce on-site consumption. For example, Amazon Web Services claims to have an average WUE of 0.15 L/kWh. [29] In its recent application for an economic development electricity rate, a Quality Technology Systems (QTS) data center representative testified that it uses an energy-efficient, water-free-cooling system. [30] At the same time, individual data centers in our region have made the news for their high projected water demands. For example, news about a proposed CoreSite data center in Denver suggests it could use up to 900 acre-feet per year, equivalent to the annual indoor water use of 16,000 local residents, to cool a facility that will have maximum power needs between 65 and 75 MW. [31] In sum, the water used by data centers can be substantial, and depends largely on the cooling technology deployed. Water-efficient cooling systems are available but may have higher energy demands — an important trade-off to evaluate.

Data Centers Pose Additional Financial and Economic Risks to Electricity Customers

Both data centers and onshoring of manufacturing are projected to drive new electricity and water demands. However, data centers do not offer the level of economic development that traditional manufacturing offers, and data centers pose unique economic and financial risks to electricity

[26] Mytton, D., 2021. Data Centre Water Consumption, npj Clean Water (2021) 4:11; **https://doi.org/10.1038/s41545-021-00101-w**

[27] Colorado State University, Colorado Water Institute, "Water Conservation in and around the Home," R. Waskom, October 2014. **https://extension.colostate.edu/topic-areas/family-home-consumer/water-conservation-in-and-around-the-home-9-952/**

[28] Southern Nevada Water Authority, "2025 Water Resources Plan Executive Summary," 2025. **https://www.snwa.com/assets/pdf/water-resource-plan-executive-summary-2025.pdf**

[29] Amazon, "AWS Cloud." **https://sustainability.aboutamazon.com/products-services/aws-cloud**

[30] Colorado Public Utilities Commission "Proceeding No. 23A-0330E; Direct testimony of Travis Wright," June 23, 2023.

[31] The Denver Post," A new Denver data center could use as much water as 16,000 people every day. Should the city give it a tax break?" October 14, 2024. **https://www.denverpost.com/2024/10/14/denver-data-center-coresite-climate/**

ratepayers. Because AI and the hardware driving it are new, there are also risks that the underlying technology will change or demand for AI will change. For example, if providers charge for AI services, then data center demands may not rise as quickly as projected. These types of risks exist with conventional manufacturing, but the potential scope of energy demands driven by data centers increases the risk.

Economic Benefits of Data Centers May Not Merit Financial Incentives

Electric utilities, states, and local jurisdictions have offered data centers various financial incentives, including reduced electricity rates and tax incentives. In WRA's region, several electric utilities, including Arizona Public Service Company, Salt River Project,[32] Tucson Electric Power Company,[33] Public Service Company of Colorado,[34] and NV Energy,[35] offer economic development rates. More than half of U.S. states, including Arizona,[36] New Mexico,[37] Nevada,[38] and Utah,[39] offer tax incentives to data centers. These incentives may take the form of sales or property tax credits. And news reports have widely reported that local municipalities offer tax incentives for data centers.[40] While many utilities, states, and local jurisdictions do offer incentives, decision makers are also proposing additional restrictions or regulations on data centers and are pursuing policies like making tax incentives or economic development rates contingent on meeting certain energy efficiency standards.[41]

[32] Appendix A to Proposed Adjustments to SRP's Standard Electric Price Plans Effective with the November 2025 Billing Cycle: Proposed Standard Electric Price Plans and Riders, pg. 183.
https://www.srpnet.com/assets/srpnet/pdf/price-plans/2024/2025-Ratebook.pdf

[33] Tucson Electric Power Company, Rider 13, Economic Development Rider.
https://www.tep.com/economic-development/

[34] Colorado's Economic Development Rates were authorized in 2018 and codified in C.R.S. § 40-3-104.3.

[35] Nevada Revised Statutes, 704.7871-704.7882.

[36] Arizona exempts data centers that meet certain requirements from taxes for 10-20 years. Arizona Revised Statutes Title 41; State Government § 41-1519. Computer data center tax relief; definitions.

[37] For example, according to the New Mexico Economic Development Department, the announced BorderPlex Digital infrastructure campus could be eligible for "statutory incentives, including the High Wage Jobs Tax Credit, LEDA GRT Share, Industrial Revenue Bonds with Doña Ana County, and workforce training through the Job Training Incentive Program."
https://edd.newmexico.gov/pr/governor-announces-partnership-with-borderplex-digital/

[38] Nevada offers partial tax abatement for data centers for 10-20 years, depending on the capital investment made by the data center, the number of employees, and other factors. **https://goed.nv.gov/incentives/**

[39] Utah Admin. Code 59-12-104.

[40] The Denver Post, "A new Denver data center could use as much water as 16,000 people every day. Should the city give it a tax break?" October 2024.
https://www.denverpost.com/2024/10/14/denver-data-center-coresite-climate/

[41] See, e.g., a proposal in Virginia to establish energy efficiency and clean energy requirements (HB 2578), and a series of measures proposed in California, summarized.
https://calmatters.org/economy/technology/2025/02/data-center-crackdown-to-protect-california-electricity-rates/

A map of utilities in WRA's region that offer economic development rates.

Compared to conventional manufacturing, data centers offer minimal employment benefits because they generate very few permanent jobs. For example, in proceedings before the Public Utilities Commission of Ohio, a representative of AEP Ohio testified that large, non-data center commercial and industrial loads built in Central Ohio over a roughly five-year period brought approximately 25 direct full-time equivalent (FTE) jobs per 1 MW of new load, while data centers created less than one FTE per MW of new load.[42] In Indiana, similar employment data of under one job per MW for data center customers was cited.[43] Indiana Michigan Power Company responded in discovery that for large new, non-data center customer loads less than 150 MW, the incremental jobs created were between 11-97 jobs per MW of new load.[44] According to the witness, Amazon Web Services has announced that its proposed new facility would create less than one job per MW.[45] While data centers may generate short-term construction jobs, they generate very few permanent jobs.

Data centers also have high capital costs to acquire and install servers, including the underlying infrastructure. Because state and local taxes are often levied on property value, the high capital costs of data centers can translate to high tax revenues for state and local governments. However, if local or

[42] Public Utilities Commission of Ohio, Case No. 24-508-EL-ATA; Direct Testimony of Lisa O. Kelso on Behalf of Ohio Power Company, May 23, 2024.
[43] Indiana Utility Regulatory Commission Case No. 46097; Direct Testimony of Benjamin Inskeep on Behalf of Citizens Action Coalition of Indiana page 13, October 15, 2024.
[44] Specifically, in discovery, Indiana-Michigan Power Company stated that there were 15.2 jobs created per MW of new non-data center load in 2023, 11.3 jobs/MW in 2022, and 96.5 jobs/MW in 2021. Indiana Utility Regulatory Commission Case No. 46097; Direct Testimony of Benjamin Inskeep on Behalf of Citizens Action Coalition of Indiana pg. 13, October 15, 2024.
[45] Indiana Utility Regulatory Commission Case No. 46097; Direct Testimony of Benjamin Inskeep on Behalf of Citizens Action Coalition of Indiana, October 15, 2024.

state entities waive property taxes for data centers, they will see little, if any, economic benefits from data centers.

Data Centers Pose Unique Economic and Financial Risks to Electric Utility Customers

If not well-regulated, data centers can impose financial impacts on other electric utility customers. Those impacts result from the uncertainty of data centers' load forecasts and interconnection requests, power quality investments required by data centers, and power-quality impacts created by data centers.

First, requests by data centers to interconnect to the grid may reflect speculative growth and energy demands. For example, if a data center requests to interconnect for 100 MW of power that it expects to come online within five years, and that load does not materialize — possibly because the computing hardware becomes more efficient, demand for AI does not materialize, or the business fails — then the utility's other customers are at risk for paying the cost of generation and transmission resources developed to meet that load. State regulators are addressing this risk by requiring data centers to provide additional assurances that they will pay for utility investments, and by requiring them to sign long-term electricity service contracts with **demand charges** at a high percentage of the capacity requested.[46] Today, electric utilities have various strategies to incorporate uncertainty into the interconnection requests of data centers, but there is no uniform or generally accepted approach.

A person works inside a data center.

[46] For example, the settlement approved in the Indiana Michigan Power Company case (establishes that data centers' contract terms will be 12 years and the minimum billing demand is at least 80% of the contracted demand. Indiana Utility Regulatory Commission Case No. 46097; Settling Parties' Notice of Acceptance of Modification to Settlement, February 25, 2025.

Second, data centers have more sensitive power quality needs than other types of customers. Momentary interruptions in power or fluctuations in voltage and harmonics can place additional wear on data center equipment or cause servers to use more energy; both impose costs. However, system investments that address those unique power-quality needs may unfairly impose costs on other customers, if not appropriately allocated.

In New Mexico, the group representing large industry customers, including data centers, supported a provision in Public Service Company of New Mexico's (PNM) recent rate case committing the utility to "dedicate investments" to evaluate and work toward addressing power quality issues such as momentary interruptions. [47] The settlement terms in the rate case identified the commitment as "relevant for customers whose electric service and operations are negatively impacted by such momentary interruptions." [48] Unless regulators take affirmative steps to ensure those customers who require this higher level of power-quality are responsible for paying the associated costs through future tariffs, rate cases, and cost allocation methodologies, non-data center customers will wind up subsidizing these upgrades.

Third, data centers may desire high power quality, but the large new loads can also cause deteriorating power quality — and associated costs — for the utility system and other utility customers. Large loads can place strain on the distribution grid, particularly if their power needs fluctuate, which can result in distorted frequency or voltage levels, generally described as **bad harmonics**. These power-quality issues can affect customer appliances, which are designed to operate with a certain level of power quality, causing more wear and tear on them. In extreme circumstances, poor power quality can result in power surges, brownouts, or blackouts. A recent study found bad harmonics to be correlated with homes located near data centers. [49] These power quality issues can also affect large-scale generating infrastructure on the grid. In Texas, the grid operator, ERCOT, observed a 50 MW sub-synchronous oscillation from a large load when that customer's load was above 300 MW. [50] ERCOT determined that the root cause was old firmware, but noted if the large load had been co-located with a generator, the oscillations would have damaged the generator. [51]

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[47] New Mexico Public Regulation Commission Case No. 24-00089-UT; Direct Testimony In Support of the Unopposed Comprehensive Stipulation of Brian C. Andrews, January 10, 2025.
[48] New Mexico Public Regulation Commission Case No. 24-00089-UT; Direct Testimony In Support of the Unopposed Comprehensive Stipulation of Brian C. Andrews, January 10, 2025.
[49] Bloomberg, "AI Power Needs Threaten Billions in Damages for US Households," Nicoletti, L., N. Malik, and A. Tartar, December 2024. **https://www.bloomberg.com/graphics/2024-ai-power-home-appliances/**
[50] ERCOT Large Load Oscillation Event Presentation, March 4, 2025. **https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.ercot.com%2Ffiles%2Fdocs%2F2025%2F02%2F28%2FLL-Oscillation_LFLTF_Mar2025_Final.pptx**
[51] *Id.*

Colors paint the sky in Albuquerque, New Mexico.

Given these issues, it is crucial that regulators ensure electricity rates fairly attribute the costs caused by different customer classes to those customers. Apart from cost allocation, electric rates can also be designed to encourage load shifting, which can help to avoid incurring some costs or reduce long-run **marginal costs** of customers that respond to the tariff design. Data centers are typically high load factor customers and have not, historically, shifted load, whereas residential customers, small commercial customers, and EV charging use cases can often shift their demands in response to demand response programs or time-of-use electricity rates.

If built at the pace and scale currently projected by utilities, data centers will have a significant impact on utilities' systems and will drive significant investment. Regulators must manage data centers' impacts on other utility customers by ensuring costs are appropriately allocated, and customer protections are in place. Those protections can ensure that utilities do not overbuild in response to uncertain or speculative loads; that power quality costs are allocated to the customers driving them; and rates reflect the costs driven by different types of customers and are designed to create incentives for data centers to provide system benefits. Section III of this report outlines several possible policy options that can protect customers.

Finally, data centers may consume utilities' existing available transmission and generation capacity, effectively crowding out other manufacturing and commercial developments which may provide higher economic benefits from tax revenue or employment. These broader, long-term opportunity costs should be weighed alongside projected economic benefits.

II. Data Centers are Driving Staggering Increases in Electricity Demand for Western Utilities

From 2010 through 2023, total annual electricity sales in states where WRA focuses its work on clean energy issues rose at a modest, steady pace, increasing by a little more than 1% per year.[52] This stable and broadly predictable load growth informed long-term electric system and emissions reductions planning. Widely adopted energy-efficient technologies enabled this stable pattern of load growth for conventional residential and commercial loads even during periods of population and economic growth. However, there was a sharp uptick in demand in 2024, with sales increasing by 4.5% in a single year — by far the largest annual sales increase over the 2010-2024 period.[53] The increase in demand from 2023 to 2024 is consistent with numerous national and regional analyses released in the last year, each of which forecasts significant growth in electricity demand in the near- to mid-term. For example:

- Grid Strategies compared national energy demand forecasts made in 2022, 2023, and 2024 for the five-year period of 2024-2029. The forecasts, which are based on data filed by electric utilities with the Federal Energy Regulatory Commission (FERC), increased dramatically over those three years. In 2022, respondents projected an overall increase in energy demand of 3.14% over the five-year period; in 2023, respondents projected a 7.33% increase; and in 2024, respondents projected a 12.52% increase. Based on the 2024 projections, the **compound annual growth rate** (CAGR) over the 2024-2029 period would be 2.4%.[54]
- WECC projects similarly staggering levels of demand growth over the next decade. In its recent report on interconnection risks related to large loads, WECC projects annual electricity demand growing by 23% over the next 10 years, from 924,000 **gigawatt hour** (GWh) in 2025 to 1.1 million GWh in 2034.[55] Similarly, WECC projects peak demands will rise by 18% over the same period, from 164 **gigawatt** (GW) in 2025 to 193 GW in 2034.[56] WECC's forecast equates to a CAGR of 2.1% over the 2025-2034 period.

These forecasts project staggering levels of load growth, but that load growth is inherently uncertain because it is based on new, evolving technologies and uncertain demand. Indeed, in April 2025, Microsoft announced a pause on nearly 2 GW of data center growth in Ohio.[57]

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[52] Calculated from EIA-861 Annual Electric Power Industry Report, October 10, 2024. **https://www.eia.gov/electricity/data/state/**

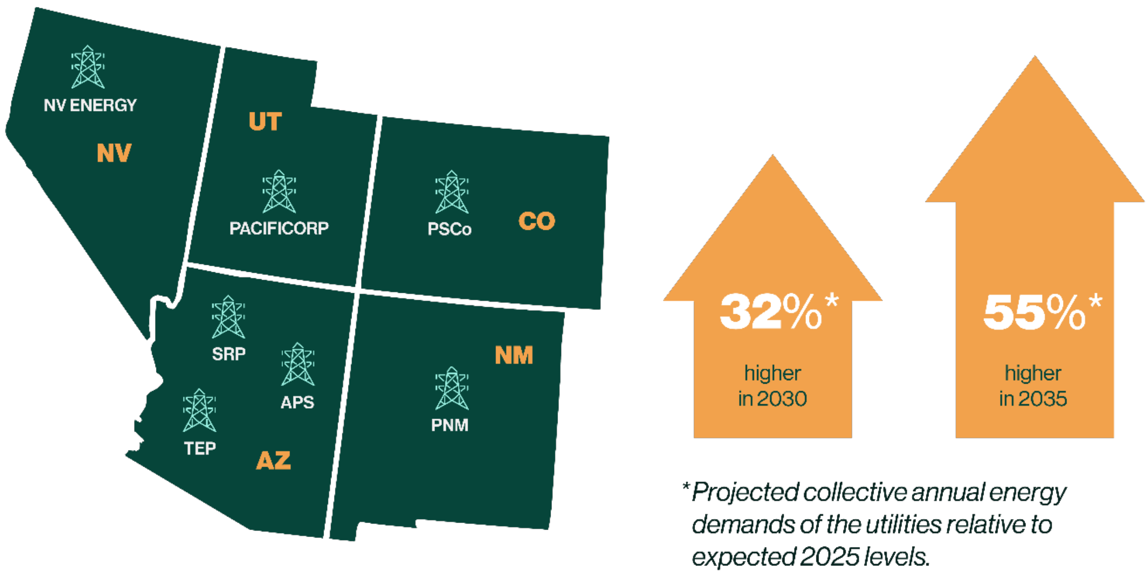
[53] Calculated by annualizing the monthly electricity sales data from EIA's Monthly Total Electricity Sales by State. **https://www.eia.gov/electricity/monthly/**

[54] Grid Strategies, "Strategic Industries Surging: Driving US Power Demand," December 2024. **https://gridstrategiesllc.com/wp-content/uploads/National-Load-Growth-Report-2024.pdf**

[55] Western Electricity Coordinating Council, "An Assessment of Large Load Interconnection Risks in the Western Interconnection," February 2025. **https://www.wecc.org/wecc-document/19111**

[56] *Id.*

[57] Associated Press, "Microsoft says it's 'slowing or pausing' some AI data center projects, including $1B plan for Ohio," April 2025. **https://apnews.com/article/microsoft-ai-data-center-pause-ohio-4d987fe8446fc9e6cda31d919f938911**



In WRA's states, seven of the eight largest utilities, including Public Service Company of Colorado (Xcel Energy), Public Service Company of New Mexico (PNM), NV Energy (NVE), PacifiCorp, Arizona Public Service (APS), Salt River Project (SRP), and Tucson Electric Power (TEP), are seeing significant interconnection requests from new large loads, including both manufacturing loads and data centers. The most recent resource plans for these utilities reflect the burgeoning new demands from data centers and manufacturing. Based on plans filed within the last two years and conversations with utility staff:

- The collective annual energy demands of the utilities are projected to be 32% higher in 2030, and 55% higher in 2035, relative to expected 2025 levels. Over the 2025-2035 period, that equates to a compound annual growth rate of 4.5%. This forecast is significantly higher than the utilities' forecasts made just a few years ago. Compared with their previous resource plans, which were filed between 2020 and 2024, the utilities' current forecast energy demands are 18% higher in 2030 and 26% higher in 2035 (Figure 1). The collective regional change in demands masks more dramatic increases from certain utilities. For example, Xcel (Colorado) projects a nearly 50% increase in energy demand in 2030, and a 75% increase in 2035, as compared to its 2021 forecast for those years. [58]
- The collective peak demand of the utilities follows a similar trend. Compared with expected peak demand in 2025, the utilities now forecast that their peak demand will be 9,500 **megawatt** (MW), or 19% higher in 2030, and 16,900 MW, or 34% higher in 2035. This equates to a compound annual growth rate of 2.9%. Again, those figures are significantly higher than what utilities expected under their previous resource plans (Figure 2).

It is important to note that the load projections reflect the utilities' base cases, *not* their load forecasts under high economic growth or with high levels of data center development.

[58] Xcel's load forecast is under review in a pending proceeding and as of June 2025, has not been approved. The pending proceeding is Colorado Public Utilities Commission Proceeding No. 24A-0442E.

These utilities, which serve the majority of demand in the Interior West, have forecasted levels of growth that exceed the projections by WECC and Grid Strategies. Figure 3 shows historic electricity sales for the five states of Arizona, Colorado, Nevada, New Mexico, and Utah projected forecast based on the WECC analysis, Grid Strategies analysis, and WRA's analysis of utilities' recent resource plans.[59] While future growth in energy demand outpaces recent historic levels under any scenario, the difference between the utilities' forecasts and the regional and national forecasts suggests that utilities are not appropriately adjusting or scaling interconnection requests to actual load forecasts and are over-projecting loads, or the selected Western utilities serve burgeoning hubs for data centers, and growth will be concentrated in those service areas. The uncertainty in load growth underscores the need for utilities and regulators to develop and follow best practices for load forecasting, as described in greater detail in Section IV.

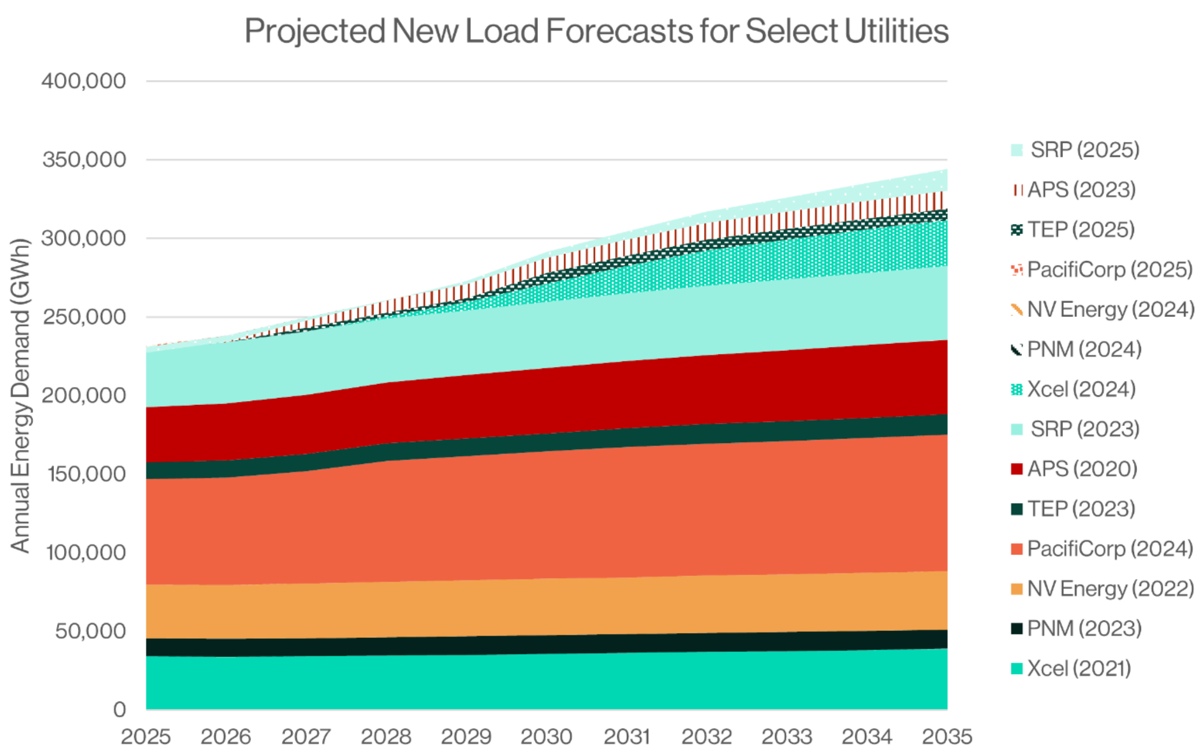


Figure 1. Projected energy demands for select utilities in Western states. The solid wedges show the energy demands projected in each utility's previous IRP, and the dashed or patterned wedges show the incremental additional demands that each utility projects under its current or pending IRP. The legend indicates the year of the IRP.

[59] The WRA analysis applies the CAGR to historic sales in the five states.

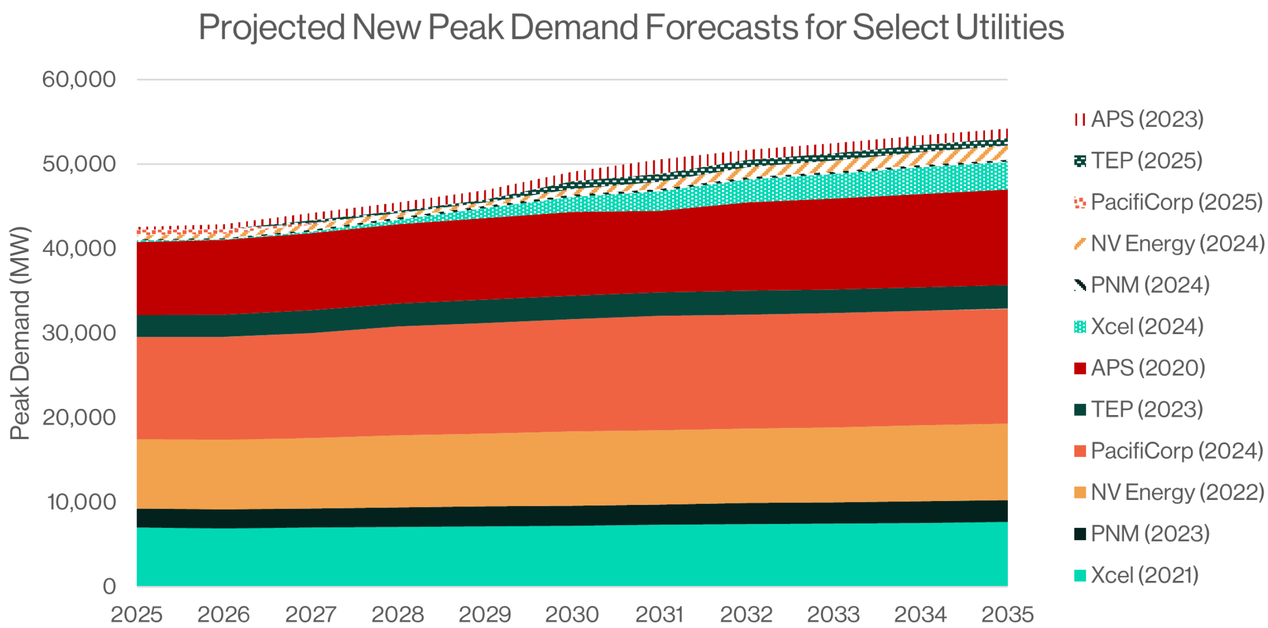


Figure 2. Projected load forecasts for select Western utilities under their current load forecasts and under the previous, most recent IRP.

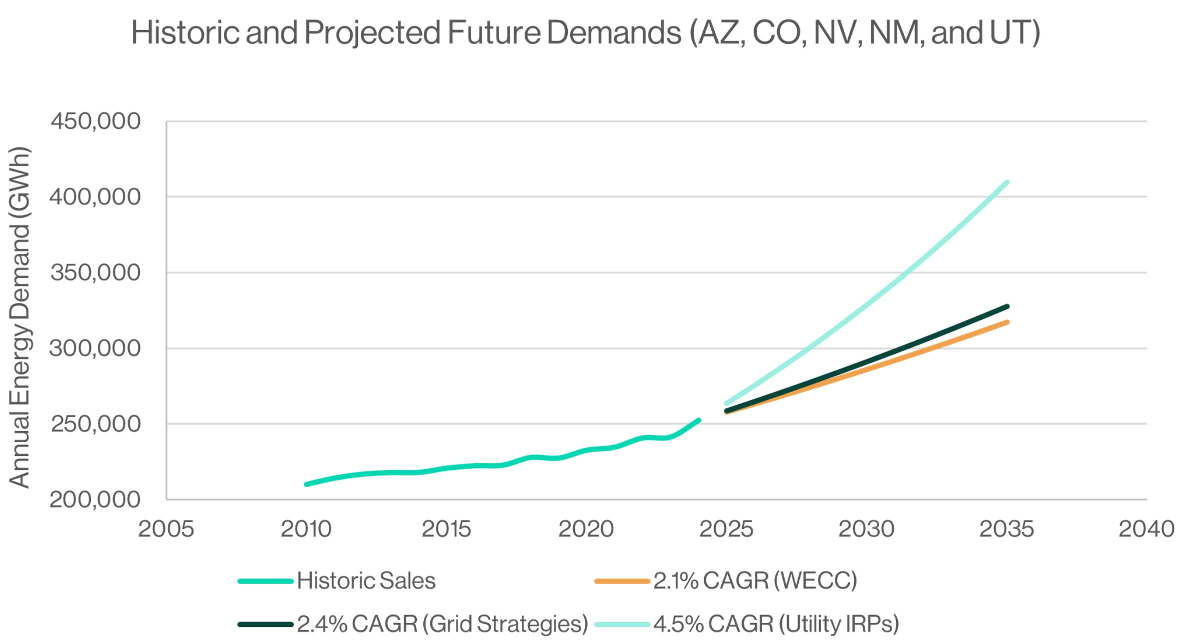


Figure 3. Historic energy sales and projected demands based on a range of compound annual growth rates (CAGR) from WECC, Grid Strategies, and WRA's evaluation of major utilities' IRPs.

There are several notable lessons from utilities' load forecasts.

First, data center demands are evolving rapidly, and utilities' forecasts have varied considerably over just a short period of time. PacifiCorp's IRPs in 2023, 2024, and 2025 are but one example of this trend. Figure 4 illustrates the annual energy demand forecast used in each plan. The IRP developed in 2023 largely preceded load growth from data centers.[60] The 2023 IRP update (published in 2024) incorporated potential data center demand, with scaling factors applied.[61] In 2025, because of the uncertainty of data center loads and Utah legislation that allows data centers to develop their own generating resources, PacifiCorp excluded data center demands from its main load forecast and modeled them as a sensitivity.[62] Utility load forecasts guide resource acquisition decisions; Figure 4 illustrates how changes in the modeling approach could have significant impacts on the utility's projected resource need and, as a result, the amount of money it will spend to acquire new resources necessary to meet that need. If the utility's load forecast overestimates future demand, the result will be unnecessary expenditures and higher costs for utility customers.

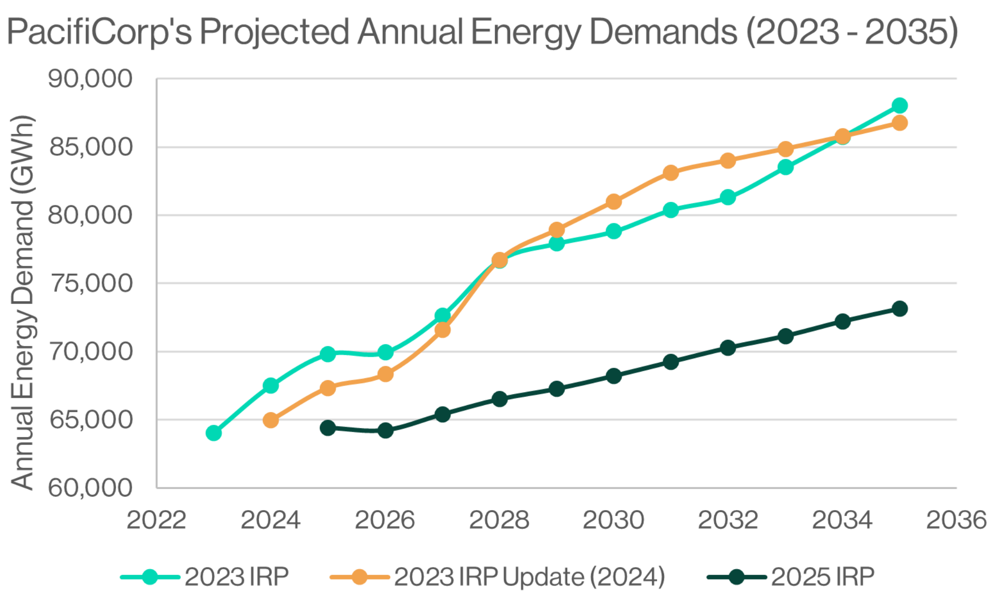


Figure 4. PacifiCorp's projected annual energy demands varied significantly over three IRP cycles.

Second, data centers are, by far, the largest factor driving load growth for these utilities. Figure 5 illustrates the relative contribution to forecast energy demands in Xcel's Colorado service territory from transportation electrification, building electrification, and data centers. Note that Xcel has robust transportation and building electrification plans, yet the impact of those forms of beneficial electrification is dwarfed by forecasted data center demands.

[60] Utah Public Service Commission Docket No. 23-035-10; PacifiCorp 2023 Integrated Resource Plan, Volume II, pgs. 7, 11 (filed March 31, 2023).
[61] *Id.* at pgs. 9, 39.
[62] Utah Public Service Commission Docket no. 25-035-22, PacifiCorp 2025 Integrated Resource Plan, Volume I, pgs. 9, 279-280 (filed March 31, 2025).

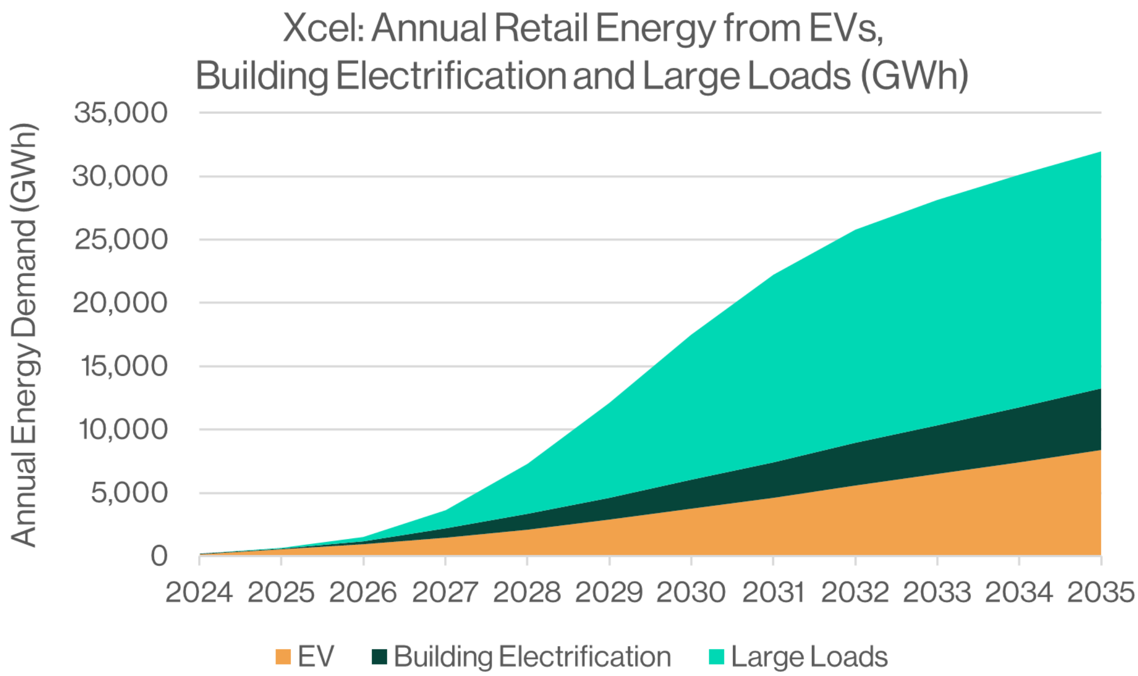


Figure 5. Forecast annual energy demands in Xcel Energy's Just Transition Solicitation. Colorado Proceeding No. 24A-0442E, Hearing Exhibit 101, Attachment JWI-2, Volume 2, Table 2.2-11.

Third, data center loads are the primary factor driving projected increases in utilities' emissions. As further detailed in the Appendix, NV Energy's explosive load growth between 2025 and 2035 stems largely from data center customers in the major projects category. To accommodate this load growth, NV Energy has proposed to significantly increase gas generation in the 2030s.[63] This proposed course of action will undermine the utility's previous emissions reductions trajectory, resulting in a 10-year delay in reaching a previous level of emissions reductions.[64]

The Appendix contains detailed data about the load forecasts for each of the utilities, based on their most recent IRP or comparable information. As noted above, the load forecasts are dynamic; the data presented here is accurate as of June 2025.

III. Data Center Growth Leads to Increased Water Demand from Cooling and Electricity Generation

If these loads come to fruition, they will also have significant impacts on the region's water resources. As noted in Section II, the water intensity of a data center varies based on a range of factors, most notably the cooling technology employed; however, it is typically proportional to the data center's energy use.

[63] Public Utilities Commission of Nevada Docket 24-05041, Direct Testimony of Timothy Pollard, Volume 2, pg. 139 (filed May 31, 2024).
[64] Public Utilities Commission of Nevada Docket 24-05041; Direct Testimony of Emily Walsh, pg. 26 (filed October 18, 2024).

Using an estimate of the national average on-site water intensity of data centers of 0.36 L/kWh [65] (equal to 95 gallons per **megawatt hour**) and the electric utilities' energy demand projections, WRA estimates the incremental, additional water demands associated with cooling data centers in the five-state region could be 13,700 acre-feet per year in 2030 and 21,600 acre-feet per year in 2035 (Figure 6). These water demands may be reduced if data centers use more water-efficient cooling technologies. For example, Salt River Project staff indicated that data centers located in Central Arizona have been using air-cooling technologies, and they expect new data centers will as well. [66]

These estimated on-site water demands for data centers do *not* include the water associated with providing electricity to data centers. If data centers are co-located with gas-fueled power plants, the local water impacts may be more significant; while the data center could use an estimated 95 gallons per MWh on-site, a water-cooled, **combined cycle gas plant** consumes approximately 300 gallons per MWh generated. [67] As shown in Figure 6, if data centers are powered by a combined cycle gas plant, their total water footprint could amount to almost 56,700 acre-feet per year in 2030 and over 89,700 acre-feet per year in 2035. If data centers are powered by water-efficient renewables, their water demands could be lower, and higher if they draw power from existing coal plants. In many states, new water supplies are not available or would increase the risk of creating water supply and demand imbalance in areas where water supplies are already stressed by existing uses. Additionally, these new water demands could be cumulatively more detrimental in areas where data center development is highest, such as northern Nevada, Central Arizona, and Colorado.

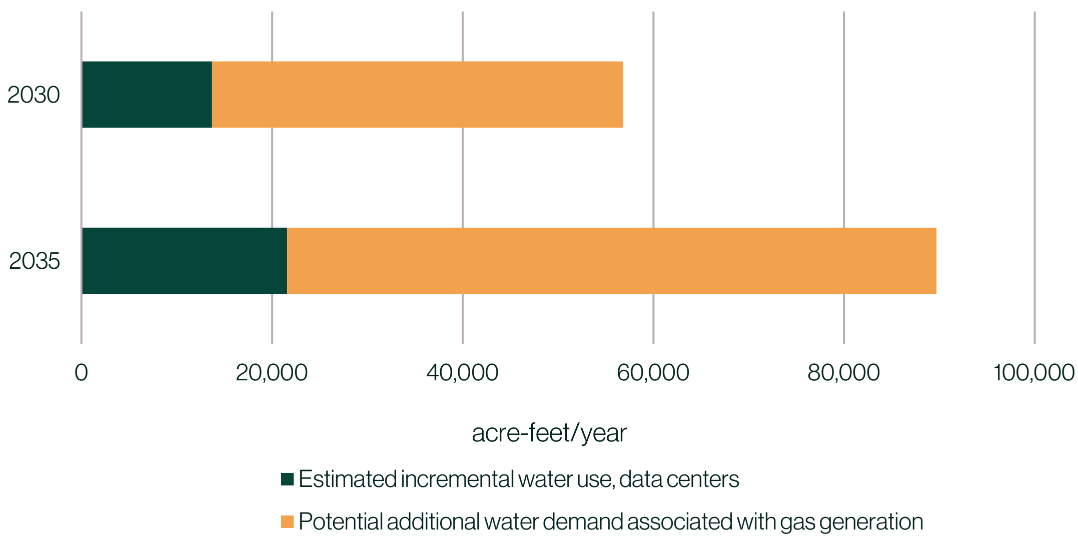


Figure 6. Estimated incremental, additional on-site water use for data centers based on average national water use intensity of data centers and estimated water use for electricity generation if data center loads are met with combined cycle gas plants.

[65] Lawrence Berkeley National Laboratory, "2024 United States Data Center Energy Usage Report," Shehabi, A., Smith, S.J., Hubbard, A., Newkirk, A., Lei, N., Siddik, M.A.B., Holecek, B., Koomey, J., Masanet, E., Sartor, December 2024. **https://escholarship.org/uc/item/32d6m0d1https://escholarship.org/uc/item/32d6m0d1**

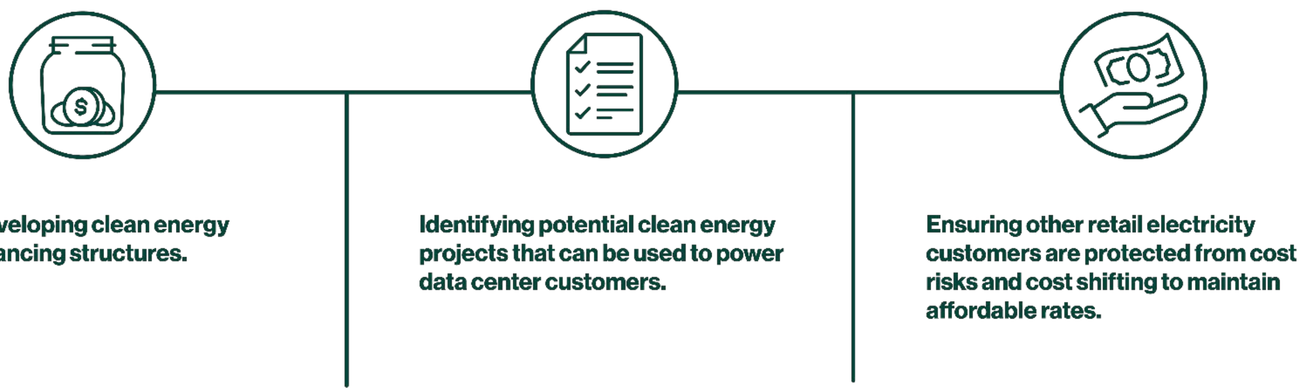
[66] Jed Cohen and Mary Faulk, Personal communication, April 3, 2025.

[67] Western Resource Advocates, "A Powerful Thirst: Managing the Electricity Sector's Water Needs and the Risk of Drought," Tellinghuisen, Stacy, October 2012. **https://westernresourceadvocates.org/publications/a-powerful-thirst-managing-the-electricity-sectors-water-needs-and-the-risk-of-drought/**

IV. Data Center Policies to Accelerate the Clean Energy Transition, Conserve Water, and Protect Customers

While the potential load growth due to data centers is staggering, smart state-level policy can help leverage data centers' resources to invest in clean energy while protecting customers and Western water resources. Many data center companies have corporate clean energy or sustainability policies and can be partners in this effort. For example, in Nevada, Google is helping develop an advanced geothermal project and worked with NV Energy to develop the clean transition tariff mechanism through which it is funded.

There are three keys to enabling rapid uptake of clean energy by data centers: developing clean energy financing structures; identifying potential clean energy projects that can be used to power data center customers; and ensuring other retail electricity customers are protected from cost risks and cost shifting to maintain affordable rates.



Advancing Clean Energy: Clean Transition Tariffs

Clean transition tariffs are an important policy tool for enabling data centers to meet their energy demands with clean resources. They can also provide a funding source for the development of innovative clean energy resources, reducing potential risks for utilities to invest in those resources, and accelerating deployment. If properly designed, these tariffs can enable data centers to do more than just mitigate their climate impacts with conventional clean resources like solar, wind, and battery storage — they can help drive innovation by scaling new clean technologies.

Clean transition tariffs are a unique program in which a large load customer commits to the purchase of a specific carbon-free resource to serve their load. To date, the tariffs have been offered as voluntary programs, but regulators could evaluate the benefits of making them mandatory for large new loads with certain energy use characteristics, like size and/or load factor. Under a clean transition tariff, the data center essentially provides financial backing for the utility to develop or procure a clean resource. The utility then sells the resource's electricity to the contracted customer. The data center customer commits to paying for the incremental up-front costs of procuring the resource, if any, as well as the electricity costs. The customer then makes a long-term commitment to purchase the resource's supply, spanning from multiyear commitments to the full lifetime of the resource.

Clean transition tariffs facilitate the development of clean resources that are additional to the utility's existing resource procurement and may support the development of innovative, early-market resources. A well-designed tariff creates a new avenue for companies to help to develop clean, firm energy technologies without passing costs or risks on to utility ratepayers.

Importantly, clean transition tariff structures should be developed in advance of a data center's request for interconnection and clean resources. For many data centers, fast interconnection is the highest priority, and a regulatory process to develop a new tariff will hinder that speed. Regulators and state policymakers should encourage utilities to develop clean transition tariff programs. In considering how to design and implement a clean transition tariff, utilities and decision makers should consider the following key questions:

What resources are eligible?	**How can a clean transition tariff function as an additional tool, outside of typical utility resource procurement, to provide carbon-free electricity to new large load customers?**	**What features are needed to ensure that residential and other commercial customers are not unjustly subsidizing the costs or risks from the tariff?**	**What provisions are necessary for robust greenhouse gas emissions accounting?**

Eligible Resources: A clean transition tariff's value as a clean energy tool is predicated on the types of resources acquired and used to serve tariff customers. In determining eligible resources, WRA recommends several provisions. First, only zero-carbon technologies should be eligible. Second, in determining eligibility, regulators must evaluate what resources provide the greatest benefits to decarbonization.

In fossil fuel-heavy states, conventional clean resources such as solar can help reduce generation at existing carbon-emitting plants and reduce emissions. In states such as Colorado, where utilities are already on an ambitious emissions reductions path, eligible resources from clean transition tariffs would ideally be limited to those that meet the data center's load profile on a daily basis or drive the development of novel clean technologies. Regulators should design tariffs in a way to drive data center customers to invest in projects that meet a large portion of a customer's annual demand — or its entirety — and incentivize customers to achieve daily or hourly matching.

Complementing Existing Resource Procurement Processes: The resources developed for clean transition tariff customers should be incremental and additional to resources procured to serve existing customers' loads. These tariffs are intended to match customers with new resources, not to allow specific customers to claim the environmental attributes of existing resources already in service. Expanding on this principle, cost-effective zero-carbon resources selected as part of a utility's general portfolio should not be made available as clean transition tariff resources, ensuring that the most cost-effective carbon-free resources are available for customers more broadly.

In practice, a utility could complete its IRP, tender a request for proposals, and select resources to serve its customers' loads. Following that process, the utility could make available any clean resources *not* selected in the IRP process for potential clean transition tariff customers. Using this approach, there may be a disconnect between data centers' desire to quickly interconnect and most states' lengthy IRP processes. While it may cause an initial delay, by maintaining a list of eligible clean energy projects, this approach could facilitate *faster* connection for data centers in the future. Alternatively, utilities could solicit bids for clean firm resources on behalf of clean transition tariff customers between IRP cycles.

Protecting Existing Customers: A clean transition tariff can advance clean energy, but it is critical to simultaneously protect nonparticipating ratepayers from any incremental costs and risks associated with clean transition tariff resources. Robust customer protections are key to ensuring the durability of these tariffs and may include: contractual requirements between clean transition tariff customers and the utility, a protocol for revenue collection, tariff provisions to ensure clean transition tariff customers are paying for capacity needs corresponding to resource procurement, and provisions governing how unused contracted energy will be treated. These provisions generally guard against shifting costs from tariff customers to other customer classes. Specifically:

- Contracts between clean transition tariff customers and the utility should require the customer to commit to the resource for either the full life of the resource, or for a set number of years, and establish exit fees to recoup these costs in the case of a customer terminating the contract. Exit fee provisions should ensure that nonparticipating customers are not held responsible for costs incurred to serve the clean transition tariff customer.
- If the clean transition tariff resource is underutilized and the utility under collects revenue from the tariff customer, those revenue shortfalls should be borne by the utility, the tariff customer, or other customers in the same rate class, such as those customers enrolled in a clean transition tariff.
- Clean transition tariffs may include a forfeiture condition in which any unused contracted power is still paid for, either fully or in part, by the tariff customer but used by the utility to serve other load. This arrangement provides benefits by potentially displacing fossil-fuel generation that would otherwise be used to serve utility's other customers.
- A clean transition tariff should include a mechanism to recover the costs for capacity resources and other **ancillary services** needed to support the load of the tariff customer. This ensures that these costs are not borne by other customers.

Robust Greenhouse Gas Accounting: Greenhouse gas accounting provisions can ensure the clean transition tariff provides real, additional, incremental emissions reductions, which is crucial to the integrity of the program. First, proper accounting for renewable energy credits (RECs) is critical. RECs generated by clean transition tariff resources should be retired by the customer or by the utility on the customer's behalf. If the utility retires the RECs generated, the utility should not count them towards any renewable portfolio standard requirements. Because a clean transition tariff resource will be operated as a system resource, with output matched to the tariff customer load, if some energy from the clean transition tariff resource is used to serve the utility's general load, the utility may use the associated RECs for renewable portfolio standard (RPS) compliance. In addition, regulators should ensure careful accounting of emissions attributes. In all Western states, the renewable energy credit includes all environmental attributes, including the emissions reductions benefit. Therefore, if a data center customer claims the REC, they also claim the emissions reductions benefit, and the providing utility must ensure it is not also counting the emissions reductions benefit. Well-designed clean transition tariffs present a promising opportunity to enable customers to develop and power their data centers with carbon-free resources. In addition to supporting private sector investment in clean energy, these tariffs can also be used to leverage investment in higher-cost, higher-risk, or innovative resources. However, clean transition tariffs must be carefully designed and contracted to ensure that additional carbon-free resources are procured, tariff customer commitments mitigate stranded asset risk, tariff customer costs are borne by the appropriate parties, and the clean energy benefits are appropriately credited.

Advancing Clean Energy: Self-Generated Behind-the-Meter Clean Energy Resources

Like clean transition tariffs, behind-the-meter (BTM) energy resources may provide an avenue to enable data centers to develop clean resources. Unlike resources procured through a clean transition tariff — which are generally utility-owned — these are located on the customer's side of the electricity meter. Data center customers may own these resources and use the energy generated by them directly. However, due to their large scale and enormous energy consumption, regulators should ensure that data centers utilizing BTM resources are paying for the other system resources that they utilize and rely on, including transmission, ancillary services, and other generation or distribution system infrastructure required to integrate, interconnect, and serve their load.

BTM resources are advantageous to data center customers for a variety of reasons. First, data centers typically require backup power, which is necessary for data centers to avoid grid disturbances that can otherwise damage expensive computing equipment and disrupt the data center's activities. Typically, data centers utilize diesel or natural gas generators for backup power, but a **microgrid** or BTM system can be designed to rely on zero-emission energy resources paired with battery storage to provide a high level of power quality. Microgrids, for example, "can provide quick dispatchable power and fast frequency response — supporting local grid stability and mimicking the effects of traditional rotational inertia." [68]

Second, BTM resources can reduce the data center's demands on the utility's transmission and distribution systems, potentially avoiding costly system upgrades that would otherwise be needed. Today, the need for new transmission and/or distribution upgrades can impose significant costs and can delay interconnection by years.

[68] UNC Energy Center, Kenan-Flager Business School, "DERs Role in a More Reliable, Sustainable, and Resilient Power System," pg. 7, David Mock and John Bush, 2024. **https://www.kenan-flagler.unc.edu/wp-content/uploads/2024/10/DER-Paper.pdf**

Finally, the acquisition of carbon-free BTM resources may appeal to data center customers with corporate sustainability goals.

WRA recommends exploring an expedited power purchase agreement, interconnection, energy supply agreement process, or other preferential treatment for data centers that commit to deploying carbon-free BTM resources. In some states, this may require legislation. Such an approach would encourage data centers to consider acquiring carbon-free BTM resources.

Additionally, WRA recommends that state utility regulators develop rules governing tariffs on **energy parks**. If multiple end users are participating in an energy park, there may be conflicts between the energy park's operation and state statutory definitions of what constitutes a regulated public utility. This must be investigated prior to opening rulemaking at the commission level.

Policies to facilitate BTM resources for data centers face some of the same questions as clean transition tariffs: what resources should be eligible? How do we protect other customers? And what provisions are necessary to ensure robust greenhouse gas accounting?

Eligible Resources: Like clean transition tariffs, BTM resource policies for data centers should prioritize clean, zero-carbon resources, and require battery storage. [69] BTM resource policies should discourage the use of fossil-fuel resources, including in microgrids and energy parks, as the reliance on methane gas or diesel turbines creates both climate and air quality impacts.

Protecting Existing Customers: Regulators, utilities, and stakeholders have long wrestled with how to fairly compensate customers with BTM generation while avoiding shifting costs to other customers. For large loads, the issues are largely the same but magnified given the size of the potential loads. Regulators should ensure that tariffs for customers with BTM generation do not unfairly shift costs to other customers.

Robust Greenhouse Gas Accounting: As with clean transition tariffs, greenhouse gas accounting is critical to the integrity of any policy to advance a data center's utilization of clean BTM generation. If the data center customer is claiming the renewable energy credits generated by the BTM resource, the utility cannot claim them. [70] If a data center develops standalone battery storage as a BTM resource, WRA recommends the utility track the charging and discharge patterns to understand the overall greenhouse gas impact. In Western states, most batteries will likely be charged during daytime hours, when energy is cheapest due to plentiful solar generation, and discharged during peak demand periods.

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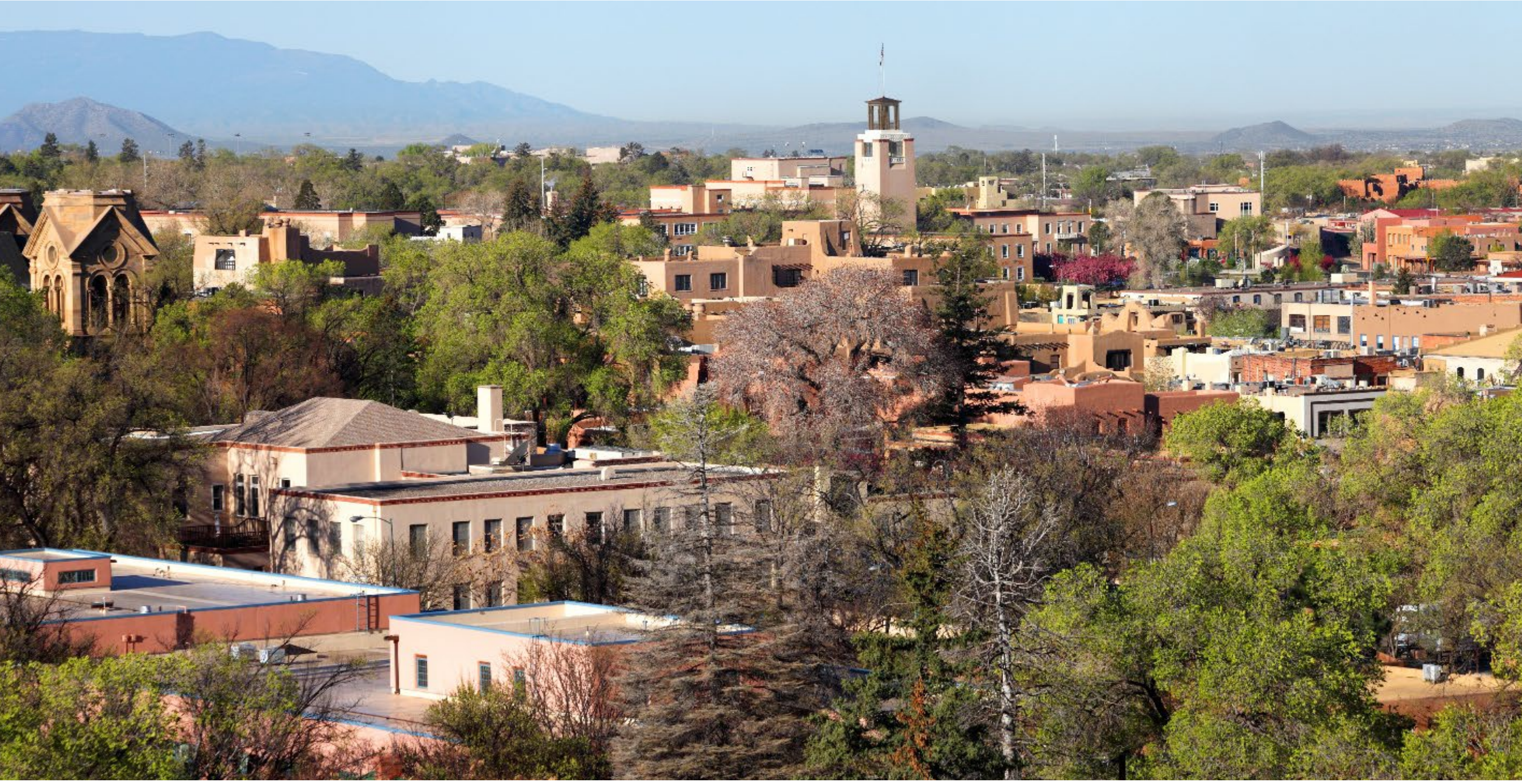
[69] In all likelihood, batteries will be charged when energy is cheapest, which is when renewable generation would otherwise be curtailed, providing an overall emissions benefit.

[70] In some states, such as Colorado, RECs also include the "avoided emissions" attributes of a MWh of clean energy generation. In such circumstances, it would also be inappropriate for the utility to claim any emissions attributes connected to the data center's BTM resource for purposes of its own emissions accounting.

Finally, it is critical that data center loads, if powered by BTM resources, are not exempted from existing state or utility climate regulations. Most Western utilities must meet energy efficiency, renewable energy, and/or emissions reductions goals. Exempting microgrids from these requirements weakens those state standards. For example, in New Mexico, legislation passed in 2025 exempts microgrids from complying with New Mexico's RPS and provisions in the Energy Transition Act through 2035.[71] Both New Mexico's RPS and Energy Transition Act are foundational policies that drive clean energy and emissions reductions. Therefore, the exemption of microgrids from utility emissions reductions requirements should be avoided. It is feared that such exemptions will lead to increased emissions, jeopardizing progress on climate goals.



A view of Santa Fe, New Mexico.

BTM resources, like clean transition tariffs, create a pathway for data centers to secure clean energy sources. Generally, these resources are more expensive than centralized power. In many instances, a clean transition tariff offering may be more cost-effective and, particularly if it is used to advance novel or innovative technologies, may offer more long-term benefits for other customers than BTM resources. However, there may be policy and cost reasons, like avoiding transmission costs or a faster path to energizing, that argue for BTM resources. Regulators should consider enabling both pathways to maximize opportunities to develop clean energy for data center customers.

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[71] New Mexico 2025 House Bill 93 (being Laws 2025 Chapter 93).

Advancing Clean Energy: Energy Efficiency and Load Shifting

Utilities can require various commitments when a data center customer requests to interconnect. For utilities, connecting a new customer typically follows a multistep process.

STEP 1

The prospective customer submits an application.

STEP 2

The utility and the customer develop the site design and sign an agreement regarding the new load, including costs to be paid by the customer.

STEP 3

Lastly, construction begins.

The capacity for the project is reserved after the customer submits their formal application. While utilities generally have a duty to extend service to new loads, they can also impose conditions that are just and reasonable — such as, requiring a prospective customer to pay a share of its line extension costs before receiving service. Other requirements that could be included as preconditions for interconnection are meeting certain energy efficiency standards and participation in demand response programs.

By incorporating state-of-the-art energy efficiency measures and cooling technology, and participating in demand response programs, data centers can significantly reduce their environmental impacts. For data centers, just and reasonable requirements could include measures that mitigate their power demand, like a commitment to energy-efficient design and equipment or participation in demand response programs. Energy efficiency measures include high-efficiency servers, high-efficiency cooling equipment, and designing a data center to optimize airflow, reducing the amount of energy needed for cooling.[72] Demand response programs can require data centers to curtail their load during peak demand periods.

A recent analysis found that nationwide, about 100 GW of new data center loads could potentially be met with minimal capacity upgrades, if those loads curtailed demand 0.5% of the year, which is typically for no more than two hours at a time.[73] Data center participation in demand response programs can benefit both utilities and data centers. Reducing peak demand can reduce the need to build new peaking resources and help manage costs, and may enable data centers to interconnect more quickly, if it avoids the need to construct new generating capacity.

[72] Xcel Energy, "Data Center Efficiency," 2021. **https://www.xcelenergy.com/staticfiles/xe/PDF/Marketing/CO-MN-BUS-Data-Center-Efficiency-Information-Sheet.pdf**

[73] Nicholas Institute for Energy, Environment & Sustainability, "Rethinking Load Growth: Assessing the Potential for Integration of Large Flexible Loads in US Power Systems," Norris, T. H., T. Profeta, D. Patiño-Echeverri, and A. Cowie-Haskell, 2025. **https://nicholasinstitute.duke.edu/publications/rethinking-load-growth**

Another option is to implement flexible interconnection agreements with data centers. Data centers may agree to a flexible interconnection contract in exchange for more rapid interconnection. Under flexible interconnection service, the data center load would be interruptible under certain circumstances identified in the agreement. Implementing flexible interconnection may provide benefits similar to demand response but at lower cost to other customers.

In some states, legislative direction may be needed to require that energy efficiency or demand response standards are met as a condition of service. Given the complexity and range of possible measures data centers could implement to decrease energy use, as well as the interaction between energy and water efficiencies of different cooling systems, specific energy efficiency requirements are best suited to a utility regulatory commission rulemaking, energy efficiency plan proceeding, or interconnection study. As such, WRA recommends that lawmakers consider legislation directing utility regulatory commissions to promulgate efficiency rules and update them on a regular basis as technology continues to evolve. This approach would provide regulators with clear direction and authority to establish these best practices, while also providing the flexibility needed for regulating a rapidly evolving industry.

Protecting Customers: Resource Planning and Acquisitions

Integrated resource planning has long been the foundation of ensuring utilities acquire the right level of resources to meet demands while managing customer costs and risks. In Western states, the most robust, transparent IRP processes have two phases. In Phase 1, the commission evaluates and approves a utility's load growth projections, among other resource assumptions, and in Phase 2, the commission approves the development and selection of resource portfolios. Data centers present unique challenges in each phase.

Ideally, the IRP process would approve utilities' load forecasts for conventional and firm load growth, such as residential and commercial loads. The process would also approve utility acquisitions of resources for certain loads, such as residential and commercial customer loads and relatively certain data center loads that already have agreements or contracts with the utility. And an effective IRP would allow for additional resource solicitations or establish a queue of clean energy projects that are "turnkey" and may be developed for data centers or other large new loads between resource plans, as the load centers come online.

> A key element of this modified IRP process would be ensuring that other customers are protected from the financial risks that could arise when utilities invest to serve forecasted data centers or other large loads that do not materialize.

Load Forecasting: Robust, reliable load forecasting is integral to ensuring utilities acquire the right level of resources. Underestimating load could leave the utility ill-equipped to meet demands, while overestimates can result in unnecessary resources on the system, driving up customer costs.

Today, there is not one best practice for forecasting uncertain data center loads, and Western utilities take very different approaches. Many utilities discount load forecasts provided by potential new data center customers by applying a scaling factor to the data center loads. Data center projects that are further along in the design and interconnection process may be assigned a higher scaling factor, while newer projects may be assigned a lower factor.

For example, in Xcel Energy's recent Just Transition Solicitation proceeding,[74] the utility models two segments of data centers. For data centers with a greater than 80% chance of interconnection, Xcel includes all the requested capacity in its load forecast. For data centers with a 50% to 79% likelihood of interconnection, the modeled load equals half of the requested load multiplied by the probability of interconnection.[75] The probability that a data center will be built and interconnected to the system is a hypothetical and subjective assessment, until an interconnection contract is signed. These contracts also include an appropriate penalty if the customer forfeits interconnection.

In contrast, in PacifiCorp's 2025 IRP, the utility excludes all data center loads from its primary forecast and models a sensitivity that includes 100% of the interconnection requests.[76] Under this approach, PacifiCorp and stakeholders can clearly see the cost of the additional generating and transmission capacity needed to meet data center loads, if they all come to fruition. These are two examples of differing approaches, and both are susceptible to error and incomplete information.

Data center load is uniquely challenging; data centers often apply for interconnection in several jurisdictions to secure the best deal or fastest interconnection.[77] Knowing the number of different interconnection requests a single data center customer has made would better help predict the probability of load materializing, but that data is not currently available to the public.[78] This is further complicated by the phenomenon of "speculative interconnection requests from developers with land and access to grid power, with or without a solid partnership or agreement in place."[79] Understanding that data centers may sign contracts with multiple utilities for the same project — while only intending to proceed with one — WRA recommends that even contracted agreements be treated as speculative load. Speculative load has a weighting factor assigned to it to indicate the likelihood that it will occur. For instance, a 100-MW project assigned a .45 weighting factor would result in the utility modeling 45 MW in its load forecast. Data center loads that have submitted requests, but not signed agreements with the utility, should have a lower weighting factor to indicate the uncertainty of that load materializing.

To improve load forecasting, utilities could require prospective data center customers to disclose the existence of any duplicative requests submitted to other utilities as a condition of obtaining an

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[74] Colorado Public Utilities Commission Proceeding 24A-0442E.

[75] For example, for a request to connect an 80 MW load that is assigned a 50% probability of interconnection, the modeled load would be 80 MW ÷ 2 * 50%, or 20 MW. Colorado Public Utilities Commission Proceeding 24A-0442E; Hearing Exhibit 107, Direct Testimony and Attachments of Thomas L. Bailey, pgs. 27-28 (filed October 14, 2024).

[76] See Utah Public Service Commission Proceeding 25-035-22 PacifiCorp 2025 Integrated Resource Plan, Volume I, pgs. 279-280 and PacifiCorp 2025 Integrated Resource Plan, Volume II, pg. 18 (filed March 31, 2025).

[77] Canary Media, "Utilities are flying blind on data center demand. That's a big problem," February 2025. **https://www.canarymedia.com/articles/utilities/utilities-are-flying-blind-on-data-center-demand-thats-a-big-problem**

[78] *Id.*

[79] *Id.*

interconnection study. To improve regulators' evaluations of load forecasts, WRA recommends that public utilities commissions initiate rulemakings for how utilities should model and manage load forecasting for data centers.

A key aspect of load forecasting is determining **load shapes** and aggregating those to create a systemwide load shape. For data centers, which can have a significant impact on overall load shape and peak demand, load projections should include details on any demand-response capabilities and commitments, including flexible interconnection agreements. As described in Section II, data centers may have higher peak loads in summer due to heightened cooling needs in warmer weather. Load shapes should reflect any expected seasonal variations.

WRA recommends that large customers be required to submit their expected load shapes to the utility. Understanding data center contribution to peak load hours is critical. Because new data center loads may dwarf other load growth on a utility system, it is likely that new energy and capacity resources will be needed to serve that load, including new capacity additions required to serve their energy outside of peak load hours. To understand the system impacts of significant new loads from data centers, the utility can analyze recommended resource acquisitions with and without the data center loads in the portfolio analysis. Analysis in a resource planning process of the data center load contribution to peak periods and required system infrastructure required to serve the additional load may help to inform future rate or tariff proceedings.

Resource Acquisition: The second key component of effective resource planning is resource acquisition. In robust resource planning processes, utilities hold a transparent request for proposals (RFP) to meet the demands identified in Phase 1, and then select the most cost-effective bids. Data center loads may emerge virtually overnight and often seek rapid interconnection. In contrast, utilities' resource planning processes and subsequent RFPs may only occur every 3-4 years. At present, several Western utilities are evaluating how to modify their resource acquisition processes to accommodate data center loads. [80]

Modifications to traditional resource planning processes may provide benefits if implemented with appropriate guardrails, by allowing utilities to be more responsive to emerging loads and while avoiding overbuilding — and the associated risks and costs — for uncertain loads. As regulators consider modifying existing resource planning procedures, WRA recommends that resources acquired outside of the traditional IRP acquisition process be limited to clean, zero-emission resources, so that they do not threaten utilities' ability to meet clean energy or emissions reductions goals. Additionally, in subsequent rate cases, regulators must consider how the cost of resources acquired through out-of-cycle RFPs are allocated to different customer classes and identify in resource allocation processes if new generation is acquired primarily to serve a particular class or customer.

[80] In Colorado, Xcel has proposed modifying its four-year IRP cycle in two ways in its Just Transition Solicitation (Proceeding 24A-0442E): First, Xcel would allow some generation resource bids to predevelop in the interim years between IRPs with compensation. This effectively means Xcel would have back-up bids available if chosen resources fall through, or new load, such as a new data center, requests interconnection. Second, Xcel would hold a new resource solicitation between IRP cycles, as necessary. For example, Xcel may hold an RFP every two years.

Solar panels generate electricity in Arizona's Sonoran Desert.

Protecting Customers: Contract Provisions

Data centers' load forecasts have inherent uncertainty, and it will likely remain that way until the industry matures, and utilities and decision makers gain more planning experience. To account for that uncertainty — and the risk of costs that overbuilding utility infrastructure could impose on other retail customers — utilities and regulators are considering new contract provisions for large load customers.

If a utility expands its transmission or generation system and large new loads do not materialize, those investments may become stranded assets or may increase other costs for customers. This creates significant equity, affordability, and consumer concerns, and over the long term, makes the economic calculus for electrifying transportation, as well as residential and commercial buildings, more difficult. Large projected loads pose a stranded asset risk if anticipated customers cease to take service; accordingly, service agreements for these customers should guard against this risk. WRA recommends that contracts include multiyear minimum durations with early termination penalties, financial security assurances, and minimum billing provisions.

Minimum Contract Duration and Early Termination Penalties

Requiring a minimum contract duration can protect against stranded assets and provide certainty to the utility. Tariffs in other jurisdictions have already started to include these provisions. For instance, Kentucky Power Company filed and was approved for a revision to its Industrial General Service tariff, requiring that loads over 150 MW commit to a 20-year contract and a "requirement to make a one-time payment equal to five years' minimum billing to the Company in the event of a permanent closure of the customer's facility prior to the end of the 20-year term."[81] Early termination penalties, also referred to as exit fees, ensure that terminating the contract still places financial responsibility on the large load customer.

Similarly, Ohio Power Company's settlement requires data center loads greater than 25 MW to commit to minimum eight-year contracts after their load ramp period.[82] The settlement allows for exit fees five years after the completion of the load ramp period, with the fees being equal to minimum charges for 36 months.[83]

Indiana Michigan Power's approved settlement requires contracts of "not less than 12 years" after the commencement of a load ramp period, which can be up to five years.[84] After five years of the contract, customers have the option to pay an exit fee equal to five years of the customer's minimum bill.[85] Furthermore, the Indiana Utility Regulatory Commission notes that it will "exercise its oversight of any exit or material reduction of Large Load Customer demand."[86]

Downtown Fort Wayne, Indiana.

Customer Financial Assurances

Given the immense investment needed to serve large load customers, it may be prudent for utilities to require these customers to demonstrate adequate financial resources as a component of their contract. For customers with less secure financials, additional collateral may be required to execute a contract. As the customer continues to meet their payment obligations once service begins, the collateral requirements may be reduced or reevaluated. This approach is being taken by Indiana

[81] Kentucky Public Service Commission Case No. 2024-03005; Order (filed March 18, 2025).
[82] Public Utilities Commission of Ohio Case No. 24-508-EL-ATA; Opinion and Order (filed July 9, 2025). **https://dis.puc.state.oh.us/ViewImage.aspx?CMID=A1001001A25G09B43531I00509**
[83] *Id.*
[84] Indiana Utility Regulatory Commission Case No. 46097; Order of the Commission (filed February 19, 2025). **https://iurc.portal.in.gov/docketed-case-details/?id=b8cd5780-0546-ef11-8409-001dd803817e**
[85] *Id.*
[86] *Id.*

Michigan Power Company, which requires large load customers to provide collateral to the utility, based upon their creditworthiness rating and liquidity, allowing for full or partial exemptions of the collateral requirement for customers with strong creditworthiness and/or demonstrated liquidity.[87]

Ohio Power Company's settlement also requires customers to provide 50% of the total minimum charges for the entire contract length as collateral, unless the customer meets certain credit ratings and has assets greater than 10 times the collateral requirement.[88] The amount of collateral required is reduced by one year's minimum charges annually.[89]

Determining the relative risk of any one customer being unable to fulfill its contract terms is complex; as such, WRA recommends that this issue not have hard-and-fast guidelines but rather be governed by a general principle that higher-risk customers be required to put forth a reasonable amount of collateral to mitigate risk. State utility regulators should evaluate promulgating rules to provide utilities with further direction. Another option is legislation that could direct utility regulators to issue rules on this topic. Prior to completion of such rulemaking or legislative guidance, utilities should use available custom contract terms to require collateral payments that shield other customers from a data center's business risk.

Protecting Customers: Following Best Practices in Ratemaking

Utility regulators determine cost allocation between rate classes based on various factors, but fundamentally, this is based on a well-established regulatory principle known as cost causation.

In an electric rate case, a key step is to determine how different classes of customers — residential, small commercial, large commercial, etc. — contribute to the costs of the larger system, including transmission, distribution, and **generation resources**. These total system costs are then divvied up among these customer classes. The formulas to allocate costs by cost type and customer class are complex, and in some states have not been updated for many years. Regulators must evaluate and update these cost allocation methodologies to ensure that marginal cost, peak demand and system dispatch calculations fairly attribute cost causation to large, rapidly growing, concentrated loads like data centers.

As data center loads grow, it will be important to scrutinize their contribution to system costs and ensure data centers are paying their fair share. Data centers' contribution to new generation and transmission capacity needs, investments required to deliver higher power-quality, and any impacts on power quality created by serving data center loads should all be appropriately allocated. Fully considering all costs of new data center load may not be a part of cost allocation for many utilities today, based on an outdated assumption that any new load will have only a marginal impact on overall system costs. This assumption — and **ratemaking** approaches that rely on it — should be reevaluated.

Peak Capacity

Take, for example, data centers' contribution to peak capacity needs. If the peak demand from incremental data center load occurs during times when the grid is least equipped to handle it — like

[87] Indiana Utility Regulatory Commission Case No. 46097; Order of the Commission (filed February 19, 2025). **https://iurc.portal.in.gov/docketed-case-details/?id=b8cd5780-0546-ef11-8409-001dd803817e**

[88] Public Utilities Commission of Ohio Case No. 24-508-EL-ATA; Opinion and Order (filed July 9, 2025). **https://dis.puc.state.oh.us/ViewImage.aspx?CMID=A1001001A25G09B43531I00509**

[89] *Id.*

when residential and commercial air conditioning demand is also high, thereby driving investment in new peaking resources — the cost of new peaking resources should be appropriately allocated to those data center loads. Customers that exacerbate peak demand and push the utility to acquire new resources to meet those peaks should bear those costs. Allocating these costs to data center customers may incentivize them to consider demand reduction or BTM assets to lessen their impact on peak demands.

However, current or conventional cost allocation methodologies may not adequately consider the cost implications of sudden, large, concentrated new loads coming onto the system and driving massive new energy and capacity investments. For example, in this new era of explosive data center load growth, cost allocation calculations that consider only four or even 12 peak hours in a year are likely inadequate for reasonable cost allocation. Similarly, marginal cost allocation studies that smooth out the impacts of rapid load growth over a 25-year time frame may undervalue the cost causation implications of data centers. New cost allocation methods that incorporate an 8,760-hour probability of dispatch analysis may be more appropriate. [90]

Rate Class Differentiation

Regulators should also consider establishing a new rate class for data centers, or more generally, for customers with large loads and high load factors. This is warranted, given the unique attributes and demands of these customers. Establishing a separate rate class would help ensure utilities transparently allocate the costs driven by data centers to those customers, including costs associated with new generation and transmission and higher power quality needs. This is another way to protect existing residential and commercial customers from unforeseen risks and costs associated with data centers. Decision makers and utilities around the country are considering this today. For example, in Virginia, in response to skyrocketing data center growth, the state legislature directed the utility commission to evaluate existing customer classes. [91] Several other utilities across the country have pending proposals to separate data centers into their own rate class. [92]

[90] Regulatory Assistance Project, "Electric cost allocation for a new era: A manual," Lazar, J., Chernick, P., Marcus, W., and LeBel, M. (Ed.), January 2020. **https://www.raponline.org/wp-content/uploads/2023/09/rap-lazar-chernick-marcus-lebel-electric-cost-allocation-new-era-2020-january.pdf**

[91] Virginia House Bill 2084, **https://lis.virginia.gov/bill-details/20251/HB2084/text/CHAP0395**

[92] Knox News, "TVA develops separate electric class for data centers, which suck up power to train AI," February 2025. **https://www.knoxnews.com/story/news/environment/2025/02/20/tva-considering-separate-electric-rate-for-power-hungry-data-centers/79099631007/**; and DCD Magazine, "We Energies proposes new data center rate to shield ratepayers in Wisconsin," April 2025. **https://www.datacenterdynamics.com/en/news/we-energies-proposes-new-data-center-rate-to-shield-ratepayers-in-wisconsin/**

The state Capitol in Richmond, Virginia.

Minimum Demand Charges

Demand charges are a billing element that requires the customer to pay, in addition to their volumetric charges, based upon the maximum amount of power required over a short interval of time (generally 15 minutes to an hour) in a given period, like a month or year. Demand charges complement volumetric charges by recovering costs based on a customer's highest demand, creating a mechanism for the customers that draw a lot of power to contribute more to the costs of building and maintaining the necessary infrastructure needed to serve the system during times of peak demand. To create consistency in the revenue generated from customers subject to demand charges, some utilities' tariffs require minimum demand charges. In such a case, even if a customer does not have a certain level of demand during the billing cycle, they will nonetheless be charged for that level of demand or a percentage of it.

As it relates to data center loads, minimum demand charges can guarantee that if a data center customer requests a certain level of capacity but its load does not materialize, falls off at a later date, or fluctuates significantly on a monthly basis, that data center customer is still responsible for compensating the utility for transmission or generation capacity constructed to meet its needs.

Minimum demand charges have been proposed in several data center specific tariffs. For instance, AEP Ohio's settlement requires data centers to pay minimum demand charges of at least **"85% of the customer's highest previously established monthly billing demand during the past 11 months," up from 60% under the utility's current general service tariff.** [93] Additionally, Indiana Michigan Power requires a minimum billing demand of 80%, up from its current tariff with a 60% minimum. [94]

A view of downtown Columbus, Ohio.

Given the high energy demands of data centers, WRA recommends that tariffs to serve them include a minimum billing demand, based on contracted peak load or modified upward based on actual recorded loads. The minimum demand charge should be sustained over time based on the highest recorded load within the prior year, even if the data center customer's load drops below that level in some months. While data centers may have lower peak load in months where their computing and cooling loads are lower, the utility nevertheless must be able to recover costs associated with a data center's significant contribution to peak demand.

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[93] Public Utilities Commission of Ohio Case No. 24-508-EL-ATA; Opinion and Order (filed July 9, 2025). **https://dis.puc.state.oh.us/ViewImage.aspx?CMID=A1001001A25G09B43531I00509**
[94] Indiana Utility Regulatory Commission Case No. 46097; Final Order pg. 32 (filed February 19, 2025).

Protecting Customers: Reforming Economic Development Rates

Many states have statutory provisions to allow for discounted rates to attract new large energy loads for the purpose of bringing new jobs and economic development to the state. The basic concept of offering a discounted economic development electricity rate derives from the assumption that existing excess capacity is available on the system that is currently unutilized or underutilized. However, if the addition of a large new data center customer requires a utility to build new infrastructure or to continue operating expensive, highly polluting fossil-fueled generation otherwise slated for retirement, a discounted economic development electricity rate makes little sense.

Given the water, energy, and customer issues that data centers raise, decision makers should consider reforming economic development rates (EDRs), and whether data centers are eligible to receive such discounted rates. With a consumer protection and environmental lens, consider the following questions about economic development rates:

What is the goal of EDRs and how can they be structured to be successful?	**What conditions are necessary to ensure EDRs protect all utility customers?**	**What conditions should be required for EDRs to safeguard a state's emissions reductions goals?**

In the West, the statutes governing EDRs establish varying policy frameworks and criteria. Not all the policy recommendations described below are applicable to every state in our region.

First, the stated goal of EDRs is what the name suggests — economic development, including substantial job growth. Generally, economic development tariffs are available only to customers with loads over a certain size, reflecting an assumption that large demands for electricity are correlated with high levels of employment and/or contributions to the local tax base.

However, as discussed in Section II, unlike conventional manufacturing, data center loads are high but unlikely to host long-term substantial employment opportunities. If the assumption that large loads foster economic development, as measured by employment, is no longer valid, then large loads alone should not be sufficient qualification for an EDR. Accordingly, EDRs could be restructured and tied to criteria such as providing certain levels of employment per MW of new load, contributions to local tax revenues, or other concrete economic development metrics.

Alternatively, the statutes governing EDRs could be amended to exclude certain types of customers that are known to *not* spur economic development. As the type of loads that electric utilities serve evolves, legislators and regulators will likely need to reevaluate economic development statutes and regulations.

Second, economic development rates may allow some customers to realize discounts at the expense of others, given that EDR customers pay less than they would if they took service on a standard rate offering for their customer class. Given this, it is crucial to ensure that EDR policy enshrines protections for all utility customers. The EDR customer and utility should bear the burden of proof to establish that the EDR rate will not harm other utility customers. Statutory language can provide a foundation for ensuring that EDRs do no harm to other utility customers, are broadly in the public interest, and that the economic development customer pays for the cost of infrastructure that must be built to serve it, and also for infrastructure that would otherwise serve other anticipated load growth.

To protect customers, EDR policies should contain, at minimum, the following:

- Requirements for a discrete cost recovery methodology for all costs to serve economic development rate customers, separate from standard utility operations. If costs associated with serving EDR customers are found to be higher than the revenue recovered through that rate, rates of other regulated utility operations may not be increased to recover the difference in the utility's revenue shortfall.
- Prohibition against EDRs that are below cost of service, including the cost of acquiring any necessary new generation resources, transmission assets, distribution upgrades, power quality improvement investments, power-quality degradation prevention costs, or any other associated costs.

Third, EDR policy should be consistent with a state's climate goals, specifically any power sector decarbonization goals. In many states, adding fossil-powered resources or increasing the dispatch of existing fossil generation resources to serve new load jeopardizes these goals. Utilities across the country have announced delays to retiring existing fossil resources due to the pressures of data center-driven load growth. [95]

[95] Reuters, "Data-center reliance on fossil fuels may delay clean-energy transition," November 2024. **https://www.reuters.com/technology/artificial-intelligence/how-ai-cloud-computing-may-delay-transition-clean-energy-2024-11-21/**; Heatmap, "It's Getting Harder to Close a Coal Plant," August 2024. **https://heatmap.news/economy/coal-gas-plant-retirements**

The Craig Station burns coal in Colorado.

Protecting Water Resources: Water Efficiency and Reporting Requirements

As described in Section II, data centers' on-site water demands are driven primarily by the type of cooling system used and the local climate. Data centers that use dry-cooling technologies, such as air chiller systems, will have lower water use but higher energy use, while data centers using more conventional water-based cooling systems typically have lower energy use. Accordingly, the choice of a cooling system has clear trade-offs between water and energy use.

> For example, in Phoenix, a dry-cooled data center has no water use but uses 13% more energy annually than a comparable data center that uses a hybrid wet/dry-cooling system.[96]

[96] Conservation and Recycling, Volume 181,2022,106194, "Water-energy tradeoffs in data centers: A case study in hot-arid climates, Resources," Leila Karimi, Leeann Yacuel, Joseph Degraft- Johnson, Jamie Ashby, Michael Green, Matt Renner, Aryn Bergman, Robert Norwood, Kerri L. Hickenbottom, June 2022. **https://doi.org/10.1016/j.resconrec.2022.106194**

Local water providers and state water adequacy laws dictate the availability and cost of water for data centers. For example, a municipal or regional water supplier can establish policies and set WUE requirements for data centers or limit new data center development based on insufficient water resource availability or a provider's future growth priorities. The Southern Nevada Water Authority, which serves the Las Vegas Valley, recently adopted a moratorium on new evaporative cooling systems in commercial and industrial buildings, [97] meaning all new data centers will have to be air-cooled. And In Aurora, Colorado, high water use industries that project consumptive water demands above certain thresholds are not allowed to be developed in the service area, unless water sustainability measures are taken. [98]

Because of the trade-offs between water use and energy use, policies that address data centers' cooling systems or WUE should be shaped by local conditions, such as the availability of water — both **potable** and recycled — competing water demands, and the availability of clean, renewable energy resources. WRA recommends decision makers consider the following key objectives in determining whether and how much water is allocated for data centers.

First, a data center's water use should not harm sensitive streams or habitat. If the new water demands for a data center would require tapping **surface** or groundwater, and that water use would adversely impact valuable streams, rivers, lakes, or riparian habitat, the data center should be required to install water-efficient cooling systems such as dry-cooling or liquid-cooling systems.

Second, data centers should minimize their water demands through efficiency measures, water reuse, and offsetting water demands through investments in conservation programs. For example, a data center's layout, if it promotes efficient airflow, can reduce overall cooling needs, thereby reducing both water and energy demands. Data centers can also rely on recycled water for cooling needs to reduce pressure on potable water resources.

Finally, local jurisdictions can require data centers to offset their water use by investing in local water conservation or reuse programs and projects. For example, Phoenix requires large water users that use more than 500,000 gallons per day (or approximately 560 acre-feet per year) to offset their use by using recycled or conserved water for 30% of their water demand. [99] Similarly, East Bay Municipal Water District in California has an extensive water demand mitigation program that requires new planned communities to fully offset projected water demands through on-site and off-site conservation mitigation. [100] Other local water providers can enact similar programs to require new data centers to offset their projected water use.

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97 Southern Nevada Water Authority, "Understand Laws and Ordinances," 2025. **https://www.snwa.com/conservation/understand-laws-ordinances/index.html**

98 Aurora Water Appendix F, "Large Water Users Guide," January 2025. **https://cdnsm5hosted.civiclive.com/UserFiles/Servers/Server_1881137/File/Business%20Services/Development%20Center/Water%20&%20Other%20Utilities/2025/2025%20Water%20Sewer%20Drainage%20Standards/Appendix%20F%20Large%20Water%20Users%20Guide.pdf**

99 Phoenix Municipal Code, Section 37-52.04 "Large water users" **https://phoenix.municipal.codes/CC/37-52.04#:~:text=large%20water%20user:-,a.,7237%2C%20%C2%A7%202%2C%202024**

100 Alliance for Water Efficiency, "Water Offset Policies for Water-Neutral Community Growth," January 2015. **https://allianceforwaterefficiency.org/wp-content/uploads/2019/06/Water-Offset-Policies-for-WaterNeutral-Community-Growth150126.pdf**

A bull elk drinks from a stream of water.

Decision makers lack comprehensive information on data centers' cooling systems and water use today. To better inform decision making, state agencies should mandate that new and existing data centers publicly report their total water use, WUE on-site, and the type of cooling systems their facilities use on an annual basis. This transparent and consistent data will allow decision makers to better plan for the potential impacts of significant industry growth.

V. Conclusion

Data centers have emerged as an unexpected and unprecedented challenge to regulators, decision makers, and utilities' traditional approaches to managing energy and water demands. Left unaddressed, data center loads threaten the ability of Western states and utilities to meet statutory, corporate, and science-based emissions reductions goals, while further straining scarce water supplies. With the right policies in place, however, data centers, with their significant financial capacity, can accelerate investments in clean energy, and catalyze the development of new, innovative clean resources, like long-duration storage or geothermal that can meet high loads while driving broader system transformation.

Legislators, regulators, and other policymakers must quickly respond to the unprecedented and complex new demands of data centers. This analysis does not represent a comprehensive list of policy solutions, but rather presents a starting point of policy considerations for decision makers across the West. Decision makers must respond to the immediate challenge of meeting data centers' burgeoning energy and water demands, while also building policies that ensure data centers accelerate progress toward energy, water, and climate goals over the long term. Even as WRA continues working to understand this emerging challenge and the attendant opportunities, WRA is collaborating with utilities, customer advocates, regulators, and other stakeholders to design and develop smart policy solutions.

A row of solar panels and a wind turbine.

VI. Appendix

Arizona Public Service Company (APS)

Central Arizona has become a hub for data center development. Arizona Public Service Company (APS) has reportedly received inquiries for up to 15 GW of new capacity.[101] APS' current net summer peak load, after the effects of demand side management (DSM) and distributed energy, is approximately 8 GW. APS last published an IRP in 2023. While this predated the demand surge for AI-based data centers, the IRP still projects significant incremental, additional peak demand and annual energy demands for data centers. The 2023 IRP includes a new category of load that was not previously included in the 2020 IRP: extra-high load factor commercial customers.[102] The 2023 IRP also includes, for the first time, loads for EV charging, but these are orders of magnitude smaller than the annual energy demands and peak demands for the extra-high load factor commercial customers.

Compared to the 2020 IRP, APS projects in the 2023 IRP that:

- Annual energy demand, as measured by sales prior to energy efficiency and distributed resources, will be approximately 10 million MWh (24%) higher in 2030, and an additional 11 million MWh (24%) higher in 2035 (Figure 7). This is almost entirely due to the annual energy demands of new, extra-high load factor commercial customers.

- Peak demands will be 1,200 MW (12%) higher in 2030 and an additional 1,100 MW (10%) higher in 2035 (Figure 8). Like annual energy demands, the higher peak demands are largely due to load from the new, extra-high load factor commercial customers.[103] Figure 9 shows the customer classes' contribution to peak in select years: 2025, 2030, and 2035.

[101] Professional communication with Michael Eugenis, March 21, 2025.
[102] Arizona Corporation Commission Docket No. E-99999A-22-0046 (filed November 1, 2023).
[103] Residential and small commercial demands change slightly, and electric vehicle loads are projected to be 133 MW in 2030 and 330 MW in 2035.

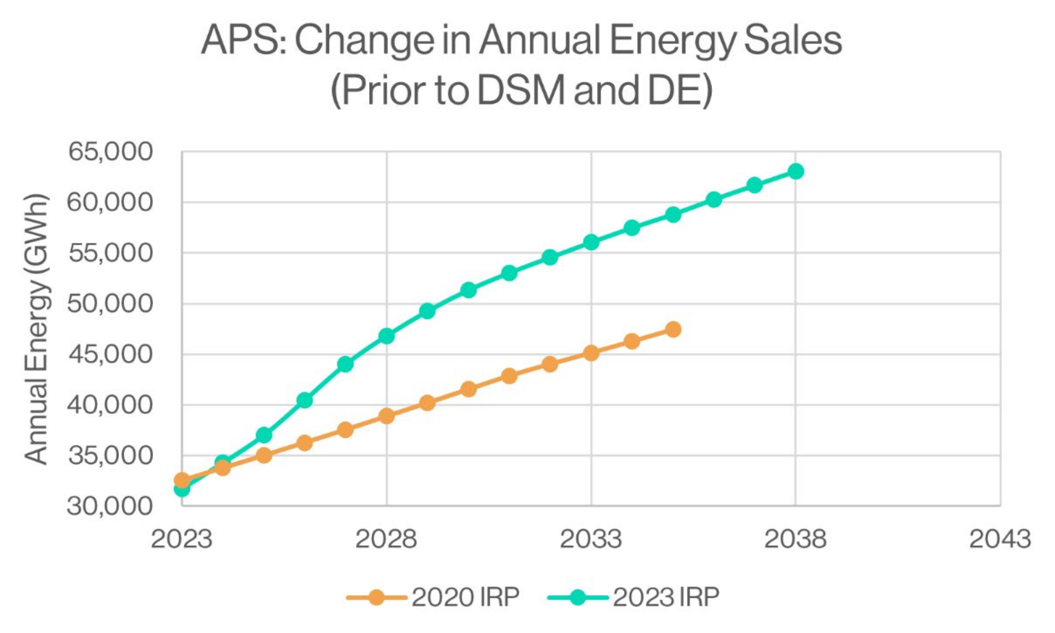

Figure 7. Change in annual energy demands between the 2020 IRP and the 2023 IRP. The figures reflect sales to customers, prior to energy efficiency and distributed resources.

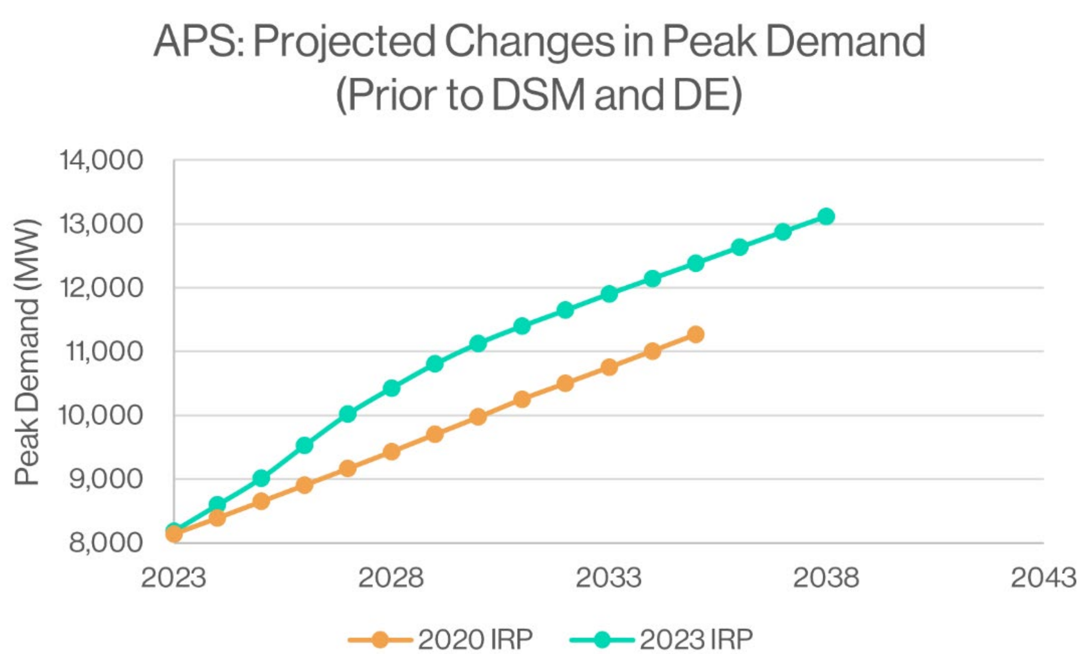

Figure 8. APS' projected peak demands, prior to DSM and distributed resources, in the 2020 IRP and 2023 IRP.

In discussions with APS, the utility indicated that it takes a conservative approach to including new data center loads in its resource planning and scales load forecasts associated with interconnection requests. APS models the loads of prospective, new customers differently from the loads of existing customers. The projected 15 GW of new demand for electricity represents prospective customers who do not have an existing utility service but have reached out to APS' economic development team. APS does not currently incorporate these loads in its resource planning or load forecasts.[104]

For customers with existing sites and utility service who request additional capacity to expand their data center, APS evaluates each customer individually to determine the likely load forecast. For hyperscalers, APS reviews the individual data center's history of expansion, evaluating characteristics like whether the data center's load materialized at the size and pace that it projected previously. For colocated data centers that request additional capacity, APS typically assumes only 50% of the requested capacity will materialize and then looks at the individual data center's historical expansion rates in determining the load ramp.[105]

APS noted that the data centers that have historically located in Central Arizona provide cloud computing services, rather than AI. As a result, their load grows more steadily, in comparison with AI data centers, whose load may increase more abruptly.[106]

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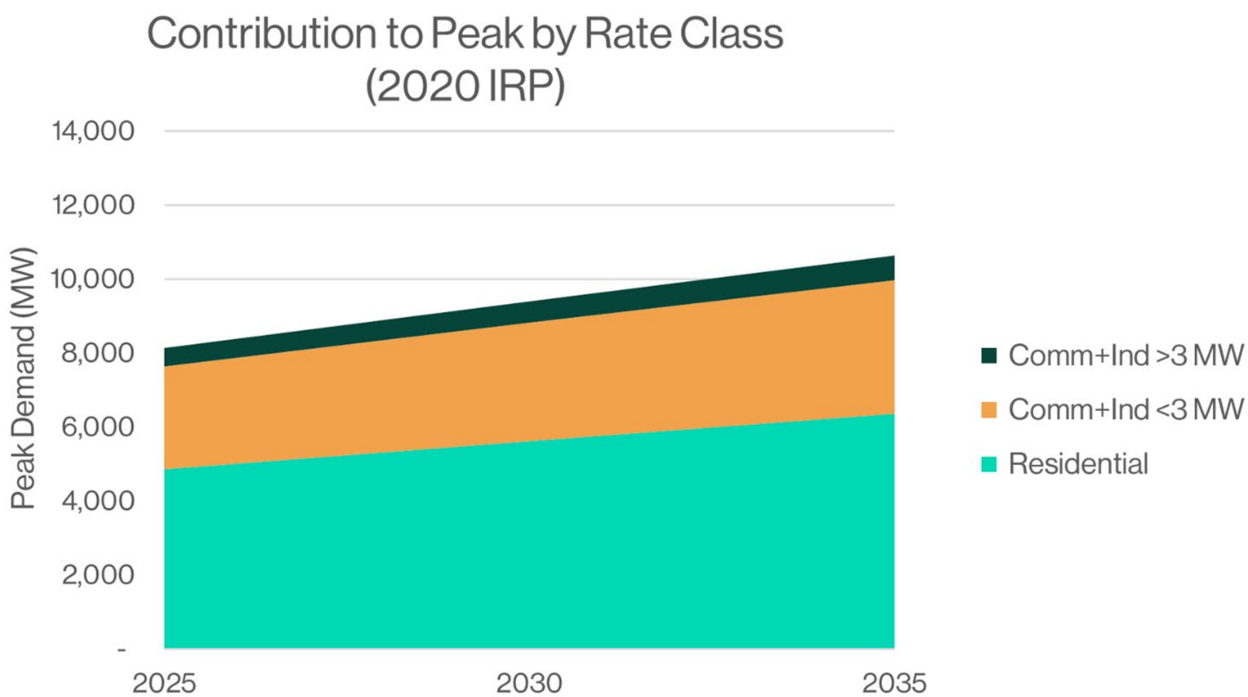
[104] Professional communication with Michael Eugenis, March 21, 2025.
[105] *Id.*
[106] *Id.*



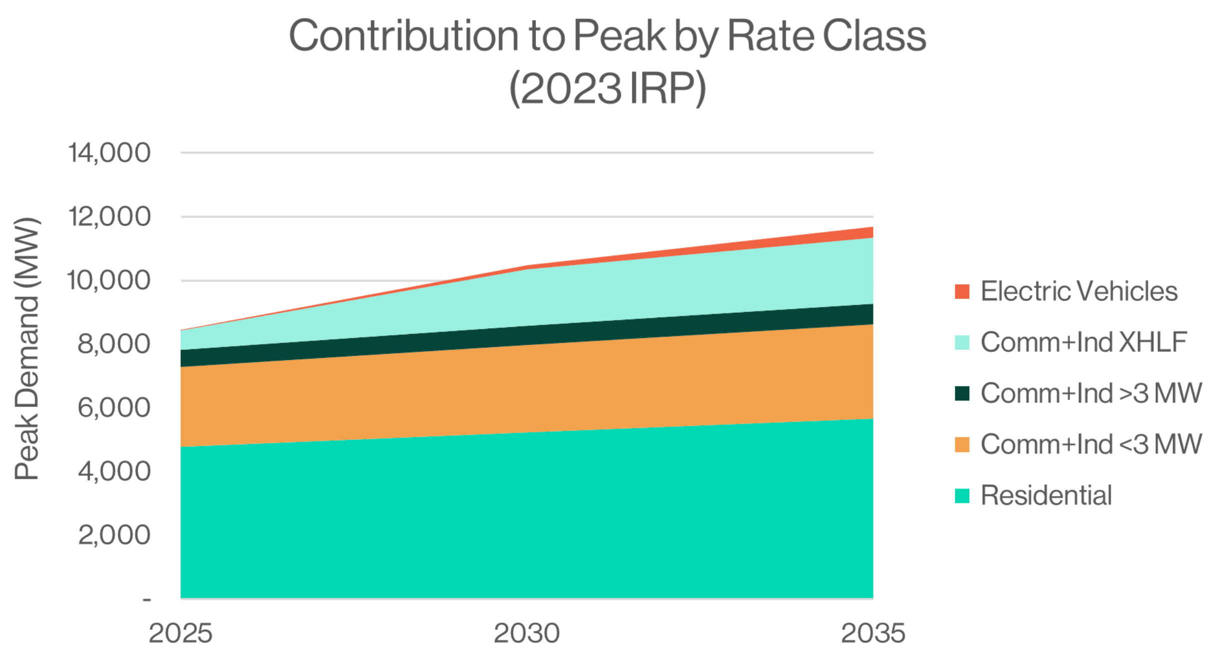


Figure 9. Comparison of customer class contribution to peak in select years of 2025, 2030, and 2035. Figures are prior to energy efficiency and distributed resources, and excludes irrigation and street lighting customers, whose contribution to summer peak are minimal. "XHLF" refers to extra-high load factor customers.

NV Energy (NVE)

NV Energy's (NVE) recently approved 2024 Integrated Resource Plan (IRP) shows significant load due to "Major Projects." While these include manufacturing, mining, and data center loads, most of the new load is due to data centers. Between now and 2033, across NVE's service territories, bundled-service manufacturing, mining, and data center projects have requested approximately 7,600 MW of capacity additions; the vast majority (85%) of this load will be in Sierra Pacific Power Company's (SPCC) service territory in northern Nevada. Almost all of the new requests — approximately 5,900 MW — are due to 12 high-load factor data center projects.[107]

This new load emerged in just the last two years. The Public Utilities Commission of Nevada approved NVE's previous load forecast in 2022.[108] Relative to the 2022 load forecast, NVE now projects:

- Systemwide, annual energy demands will be 18% higher in 2030 and 34% higher in 2035. This translates to rapid growth between now and 2030; annual energy demands will grow by 31% between 2023 and 2030 and by 54% between 2023 and 2035. This demand is being driven primarily by unprecedented projected load growth in NV Energy's northern service territory, Sierra Pacific Power Company. Sierra Pacific's annual energy demand is projected to increase by 64% from 2023 to 2030 and more than double between 2023 and 2035.[109] (Figure 10)

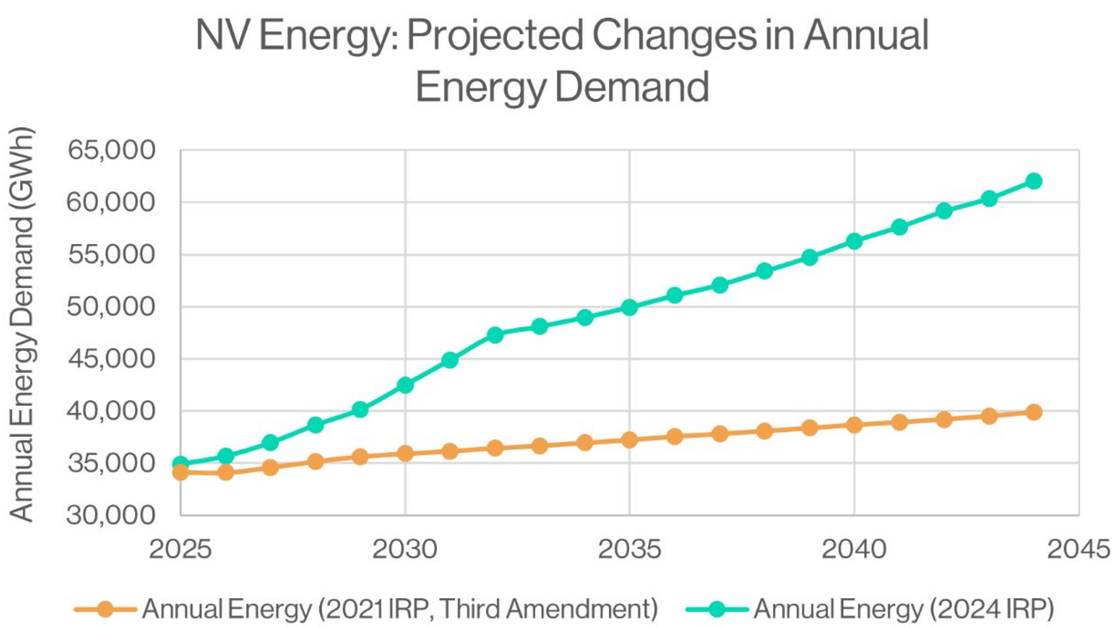


Figure 10. Projected annual energy demands under the 2024 IRP are significantly higher than under the 2021 IRP's third amendment (approved in 2022).

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[107] Public Utilities Commission of Nevada Docket No. 24-05041, Direct Testimony of Timothy Pollard, Volume 2, pg. 139 (filed May 31, 2024).
[108] Public Utilities Commission of Nevada Docket 22-09006; Third Amendment to the 2021 IRP.
[109] Public Utilities Commission of Nevada Docket 24-05041, NV Energy's Joint Triennial Integrated Resource Plan; Original Application, Volume 6, pg. 53; Appendix LF-1, Load Forecast (filed May 31, 2024).

- Peak demands also show staggering levels of growth. Relative to the previous forecast, peak demands are currently projected to be 13% higher in 2030 and 24% higher in 2035.[110] (Figure 11)

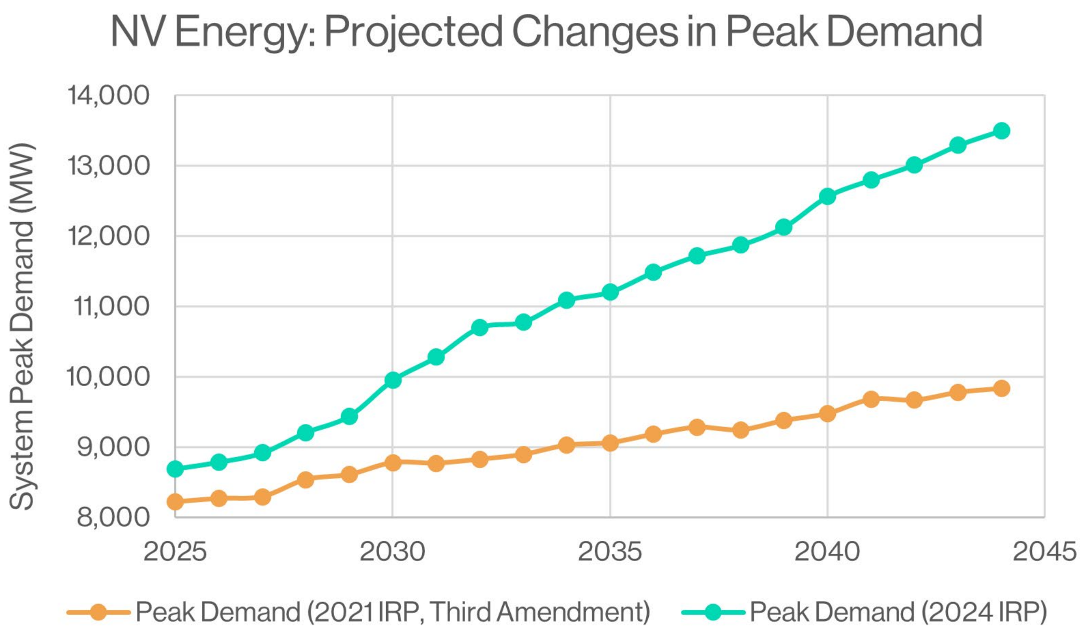

Figure 11. Projected peak demands under the 2024 IRP are significantly higher than under the 2021 IRP's third amendment (approved in 2022).

While NVE projects some new load from EVs and population growth, they are dwarfed by projected new data center demands. Looking specifically at Sierra Pacific, over the next decade, the projected energy demand for Major Projects will be 2.5-3.5 times greater than the amount of energy used by residential customers, and roughly 10 times the amount used by EV charging (Figure 12). In Sierra Pacific's service territory, data centers account for the vast majority (79%) of the new energy demand in the Major Projects category between 2023 and 2030.[111]

Like other utilities, NV Energy applies a scaling factor to Major Projects' interconnection requests, so the load forecast in the IRP represents only a portion of the total capacity requested to date. In its IRP load forecast, NVE reduced the capacity requested by Major Projects 48% for projects with signed agreements, and 85% for projects that were still in the engineering study phase.[112] If all the proposed projects materialized, the potential load could be significantly higher.

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[110] Public Utilities Commission of Nevada Docket 24-05041, NV Energy's Joint Triennial Integrated Resource Plan; Original Application, Volume 6, pg. 53; Appendix LF-1, Load Forecast (filed May 31, 2024).
[111] Public Utilities Commission of Nevada Docket 24-0504; Direct Testimony of Emily Walsh Attachment 3 (filed October 18, 2024).
[112] Public Utilities Commission of Nevada Docket 24-05041, NV Energy's Joint Triennial Integrated Resource Plan; Original Application, Volume 2; Direct Testimony of Timothy Pollard, pg. 19 (filed May 31, 2024).

NVE has not proposed to offset these dramatic increases in forecast demand with commensurate amounts of clean energy. As a result, NVE projects substantial increases in the amount of fossil gas generation on its system in 2030 and 2035, and additional incremental annual greenhouse gas emissions of 3.2 million tons in 2030 and 2035. [113] The emissions reductions NVE previously expected to achieve will be delayed by 10 years. [114]

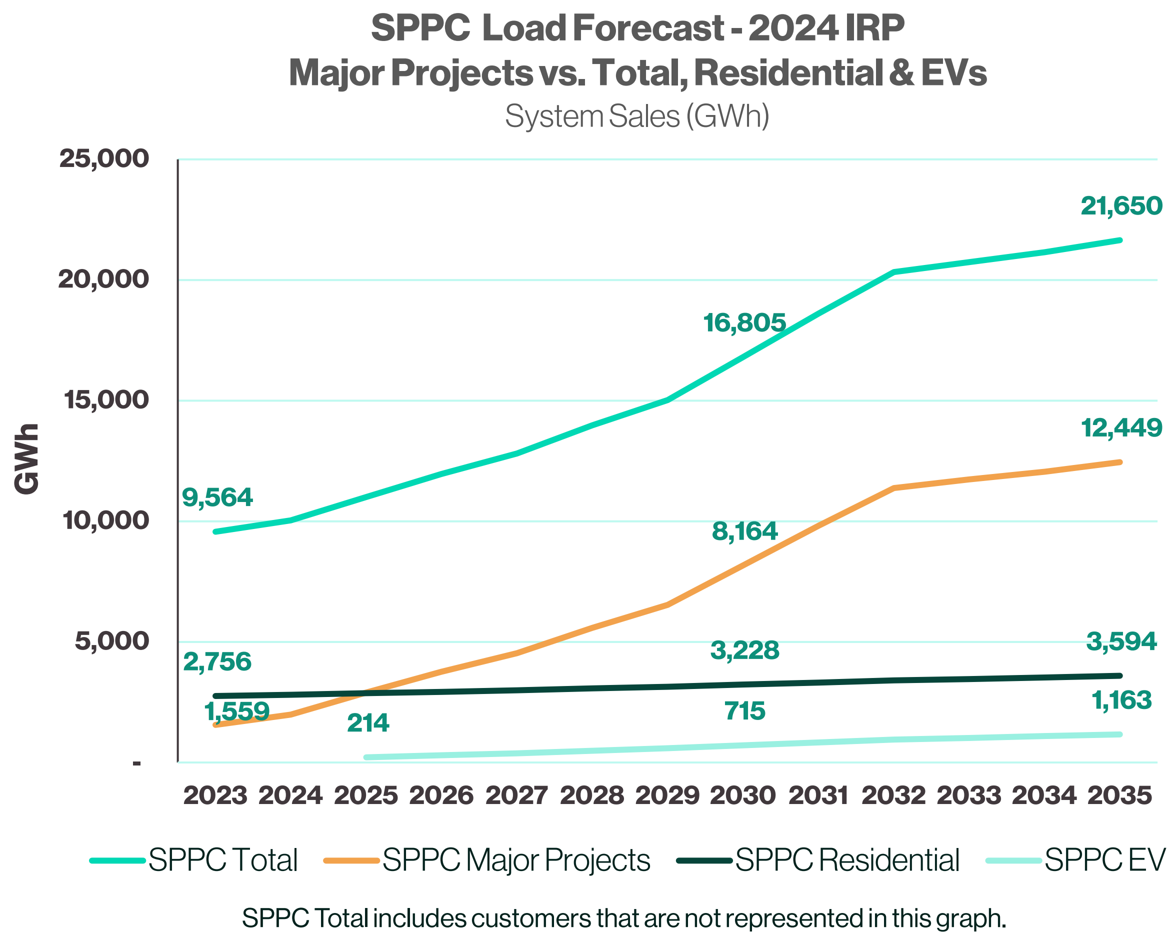

Figure 12. Forecast annual energy demand in Sierra Pacific Power Company's service territory, comparing major projects, residential, and EV charging loads.

[113] Estimated change in emissions between the 2024 IRP Balanced Plan (Public Utilities Commission of Nevada Docket No. 24-05041), and the Fifth Amendment to the 2021 IRP (Public Utilities Commission of Nevada Docket No. 23-08015).

[114] Public Utilities Commission of Nevada Docket 24-0504; Direct Testimony of Emily Walsh pg. 26 (filed October 18, 2024).

PacifiCorp

PacifiCorp published an IRP in 2023, an IRP Update in April of 2024, and an IRP in 2025. Across those three filings, PacifiCorp's load forecast has changed considerably.

In the update filed in early 2024 [115] the utility forecasts significant additional demand in Utah, largely driven by data center loads. [116] Specifically, in the 2024 update, PacifiCorp's annual energy demand forecast for Utah is 11% higher in 2030 — a 3.6 million MWh increase — compared with the 2023 IRP forecast. Similarly, in the 2024 update, PacifiCorp projected its peak demand in Utah would increase by 8% (511 MW), relative to the previous forecast. Across PacifiCorp's system, the increased load in Utah is counterbalanced by reduced load in several other states, resulting in a more modest net change in load in the update, relative to the 2023 IRP.

In PacifiCorp's 2025 IRP, however, the utility took a different approach and excluded any potential data center loads from its base forecast. As a result, PacifiCorp's 2025 load forecast appears significantly lower. Because of legislative actions in Utah in 2025, it is possible that new data centers located in Utah may develop their own generating resources and not rely on PacifiCorp. [117]

In its 2025 IRP, PacifiCorp excluded data center loads from its primary modeling effort, but modeled a data center sensitivity to determine the resources needed if all potential data center interconnection requests materialize. The incremental additional data center load is approximately 6,000 MW in 2030 and 7,000 MW in 2035. PacifiCorp forecasts the need to add the following resources by 2038 in order to meet this potential load growth, in addition to the resources added under PacifiCorp's preferred plan: 2,354 MW of methane gas peaking units; 3,872 MW of utility scale wind; 5,993 MW of utility scale solar; and 9,650 MW of additional energy storage. [118]

For purposes of this analysis, WRA compared the load forecast in the 2023 IRP Update (published in 2024) with the 2023 IRP. The 2025 IRP is more recent, but because the main forecast excludes data center loads entirely, it provides no insight into PacifiCorp's expectation of what share of data center interconnection requests are reasonably expected. PacifiCorp's modeling and resource acquisition approach may better reflect the true uncertainties of data center loads and may better protect residential and commercial customers from risks of unnecessary investments. However, using the 2025 load forecast for this research analysis would undercount likely future loads in PacifiCorp's service area.

[115] Note that PacifiCorp calls it the "2023 Integrated Resource Plan Update," published in April 2024. We refer to it as the "update" or "2024 Update."

[116] PacifiCorp, 2024. 2023 IRP Update, Appendix A, Tables A.1-A.4. **https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2023_IRP_Update.pdf**

[117] Electric Utility Amendments, Utah S.B. 132 (2025).

[118] Utah Public Service Commission Proceeding 25-035-22 PacifiCorp 2025 Integrated Resource Plan, Volume I, pgs. 279-280 (filed March 31, 2025).

Figure 13 shows the difference in systemwide energy demand between the 2023 IRP and the 2023 IRP Update. The change in systemwide peak demands is small — equal to or less than 2% in any given year — and therefore not shown graphically. Figure 14 shows the projected load growth in PacifiCorp's Utah service area.

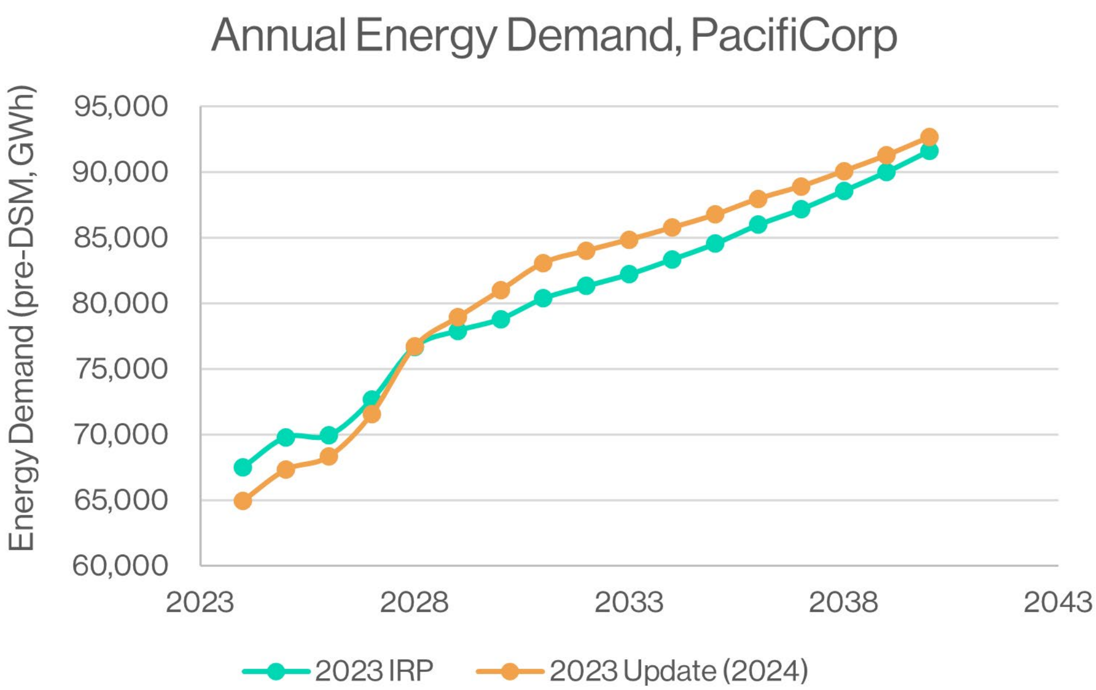

Figure 13. PacifiCorp's annual energy demands under the base case load forecast in the 2023 IRP and the 2023 IRP Update, which was published in 2024.

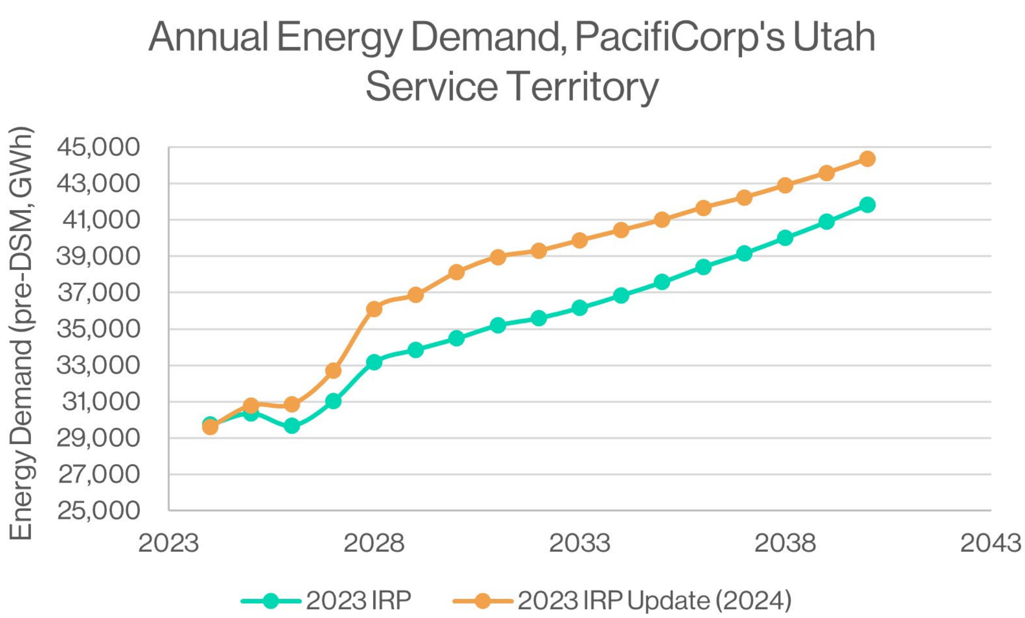

Figure 14. Annual energy demand in PacifiCorp's Utah service territory under the base case load forecast in the 2023 IRP and the 2023 IRP Update, which was published in 2024.

Public Service Company of Colorado (Xcel Energy)

In its Just Transition Solicitation (JTS), filed in October 2024, Public Service Company of Colorado (Xcel Energy) projects significantly higher demands — both peak demands and annual energy — than it forecast in its 2021 Integrated Resource Plan (IRP). While Xcel projects some incremental, additional load growth from electrification of transportation and buildings, the vast majority stems from "large loads."[119] These loads include both new manufacturing facilities and data centers. Specifically, compared to its 2021 IRP load growth forecast:

- Xcel's peak demand forecast is 25% higher in 2030 and 43% higher in 2035, relative to the forecast in its 2021 IRP. By 2030, large loads are forecast to increase Xcel's peak demands by almost 1,500 MW, relative to 2023 levels (Figure 15).[120]

- Xcel projects that its annual energy demands will be 47% higher in 2030, and 75% higher in 2035. By 2030, large loads are forecast to increase annual energy demands by 11,400 GWh (Figure 16).[121]

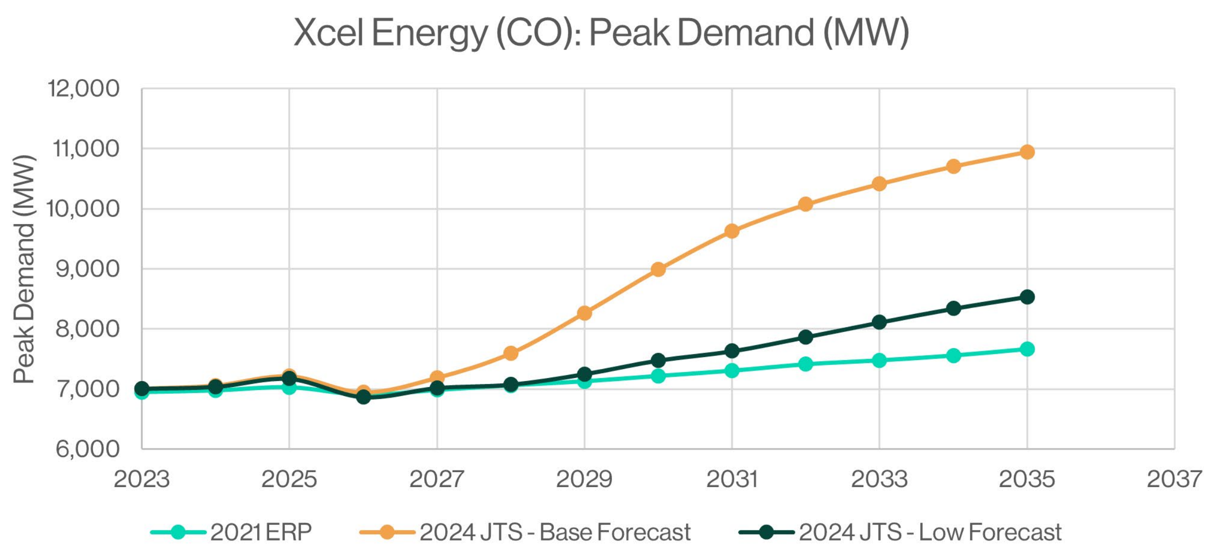

Figure 15. Xcel's peak demand forecast under the 2021 electric resource plan (ERP) and the 2024 JTS (both the base forecast and a low growth forecast).

[119] Large loads account for 62% of the energy growth and 72% of the peak demand growth through 2031. Colorado Public Utilities Commission Proceeding no. 24A-0442E; Direct testimony of J. Goodenough, Hearing Exhibit 106, pg. 6 (filed October 15, 2024).

[120] *Id.*

[121] Colorado Public Utilities Commission Proceeding no. 24A-0442E Direct testimony of J. Goodenough, Hearing Exhibit 106, Workpapers supporting figures JGD -D-1 and JGD-D-2 (filed October 15, 2024).

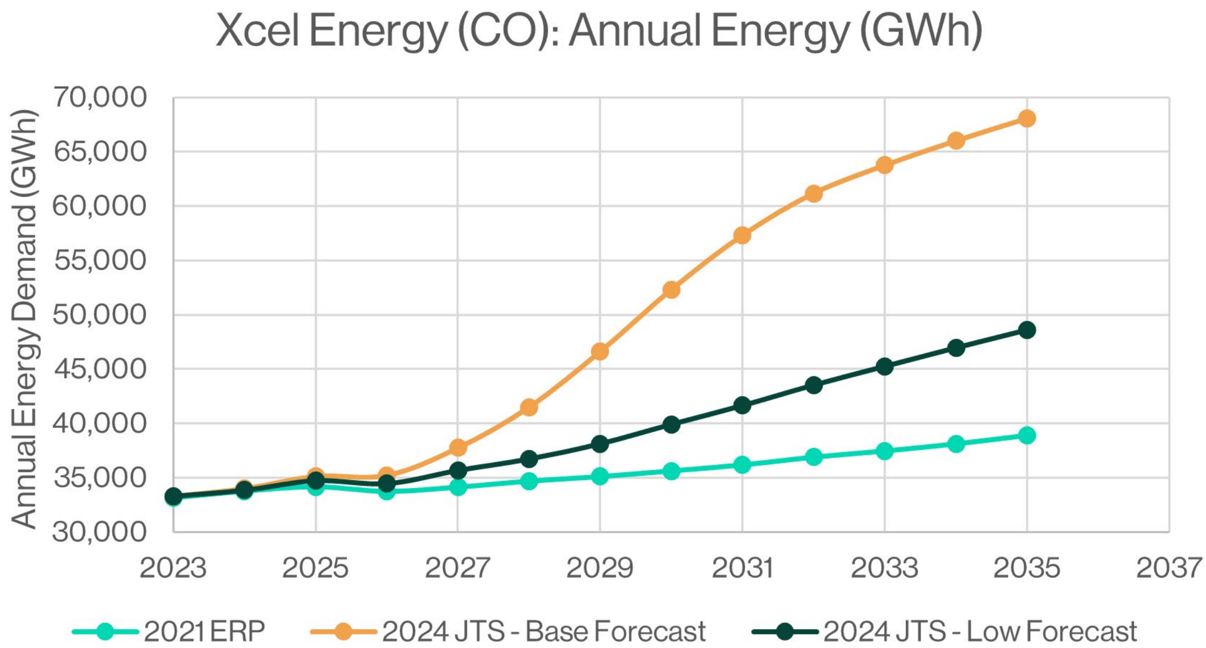

Figure 16. Xcel's annual energy forecast under the 2021 ERP and the 2024 JTS (both the base forecast and a low growth forecast).

In Xcel's JTS application and testimony, the utility states that its load forecast only includes a portion of the potential interconnection requests it has received for data centers. Xcel evaluates the likelihood of a large load facility moving forward and applies a scaling factor to the projected load. As a result, the "base" case load forecast in 2031 includes approximately one-third of the total requests for interconnection that Xcel has received from large loads. The load forecast includes incremental energy demand for buildings and transportation, but those demands are modest, compared with the large loads (Figure 17). [122]

Xcel's application highlights the potential impact of data center loads on emissions. The utility's preferred plan suggests a modest increase in greenhouse gas emissions, compared with its approved 2021 IRP; under Xcel's base plan in its pending IRP, the company would achieve an 85% reduction in emissions by 2030, [123] relative to 2005 levels, whereas under the approved 2021 IRP, Xcel would have achieved an 87% reduction. [124] This is a difference of 760,000 tons of greenhouse gas pollution. Xcel is bound by a statutory requirement to reduce emissions by at least 80% below 2005 levels by 2030, which limits the impact of this new load growth on emissions. However, Xcel identifies a growing

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[122] WRA's initial review suggests that managed EV charging could further reduce the overall peak impact of vehicle electrification.

[123] Air Pollution Control Division, April 2025 PUBLIC Base Plan (SCC).xlxs, filed in Colorado Public Utilities Commission proceeding No. 24A-0442E, Application of Public Service Company of Colorado for Approval of its 2024 Just Transition Solicitation.

[124] Air Pollution Control Division, October 18, 2023. Clean Energy Plan Verification, filed in Colorado Public Utilities Commission Proceeding No. 21A-0141E, Application of Public Service Company of Colorado, Approval of its 2021 Electric Resource Plan and Clean Energy Plan. Figure refers to the expected emission reductions under the Preferred Plan (SCC).

tension between the load forecast and capacity needed to meet it and the utility's ability to achieve deep decarbonization.[125]

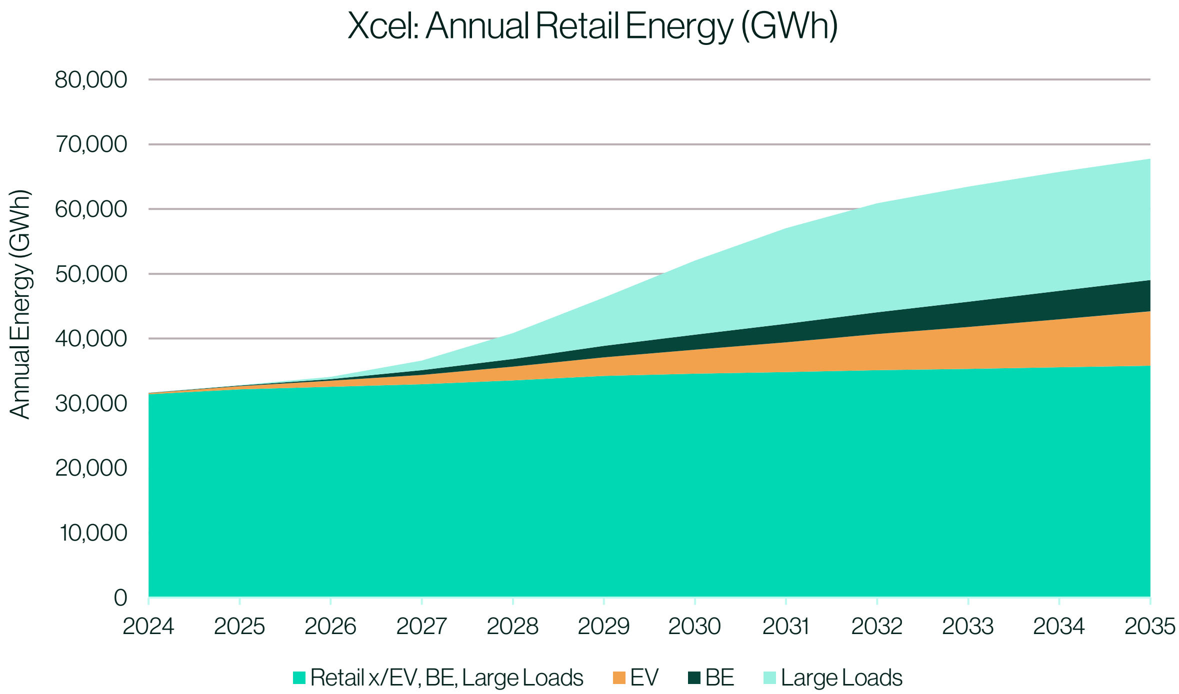

Figure 17. Forecast annual energy demand (GWh) reported in Xcel's 2024 JTS, broken into components, including electric vehicles, building electrification (BE), and large loads.

[125] Colorado Public Utilities Commission Proceeding No. 24A-0442E; Direct Testimony of Jack Ihle Rev.1 pgs. 24-25 (filed October 15, 2024).

Public Service Company of New Mexico (PNM)

In December 2023, Public Service Company of New Mexico (PNM) submitted an IRP; six months later, PNM filed a notice with the New Mexico Public Regulation Commission (PRC) noting a significant increase in its load forecast and filed a further Supplemental IRP update in October 2024. According to PNM, the change in the load forecast is due to several factors, including adjustments to extreme weather forecasting, EV loads, and "economic development" loads, which include manufacturing and data centers. In February 2025, PNM reported that it had 4,197 MW of interconnection requests by large loads, 3,654 MW (87%) of which it attributed to data centers.[126] While these loads will not all materialize, they are a driving factor behind the higher load forecast PNM reported in late 2024.

To estimate the change in load, WRA relied on PNM's Current Trends and Policy scenario in the utility's 2023 IRP and the New Current Trends and Policy scenario in the 2024 Supplemental Filing.[127] PNM also developed a High Economic Growth scenario in both filings. In the 2024 update, the New Current Trends and Policy load forecast eclipses both the 2023 Current Trends and Policy scenario and the 2023 High Economic Growth scenario over the next five years.[128] Specifically, the 2024 Supplemental Update projects that:

- PNM's annual energy demands will be 11% to 12% higher in 2030 and 2035 than they were projected to be under the 2023 IRP (Figure 18); and

- Peak demands will be 10% to 11% higher than previously forecast (Figure 19). Notably, under PNM's high economic development sensitivity, peak demands would be almost 30% higher in 2030 and 40% higher in 2035, relative to the 2023 Current Trends and Policy forecast.

As a result of the new load forecast, PNM states that it has an increased resource need in the 2028-2032 period. As a result, the utility is proposing to acquire an additional 1,000 MW of carbon-free resources, 300 MW of dynamic balancing resources, and 400 MW of firm generating resources, relative to the resources approved in the 2023 IRP proceeding.[129]

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126 New Mexico Public Regulation Commission Proceeding 24-00257, In the Matter of an Inquiry Regarding Grid Readiness and Economic Development, PNM presentation at PRC workshop, February 13, 2025.
127 New Mexico Public Regulation Commission Case No. 23-00409-UT, PNM Supplement to May 16, 2024, Notice of Material Event - Revised Statement of Need, October 10, 2024.
128 New Mexico Public Regulation Commission Case No. 23-00409-UT, 2023 IRP Supplemental Analysis, October, 10, 2024, pgs. 7-9.
129 *Id.* pgs. 22-23.

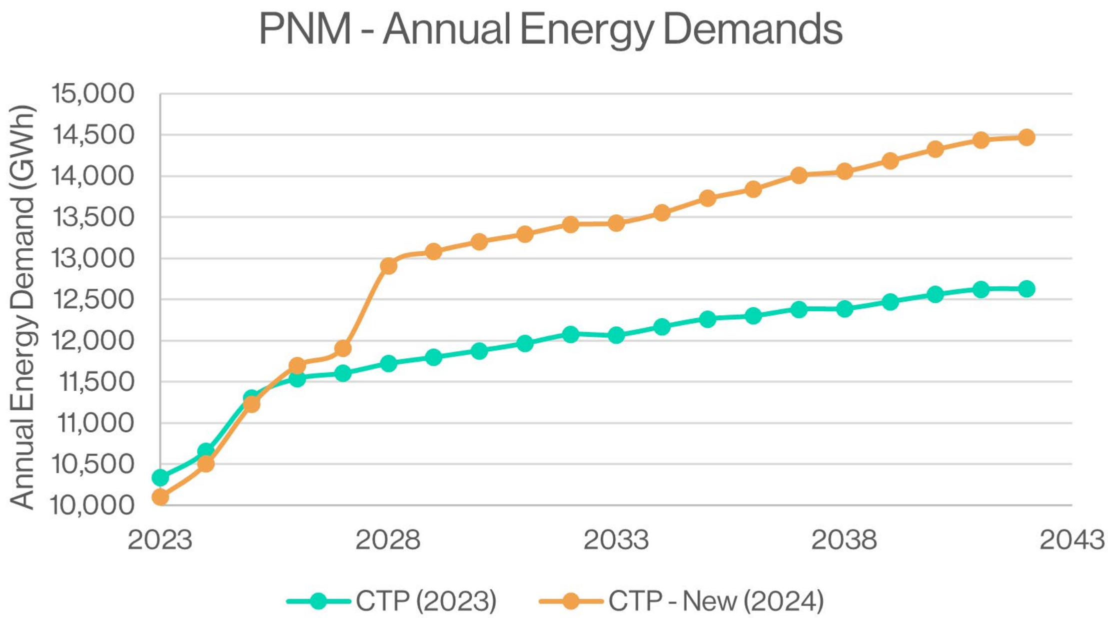

Figure 18. PNM's annual energy demands under the Current Trends and Policy (CTP) forecast in the 2023 IRP and the 2024 Supplemental Update to the 2023 IRP.

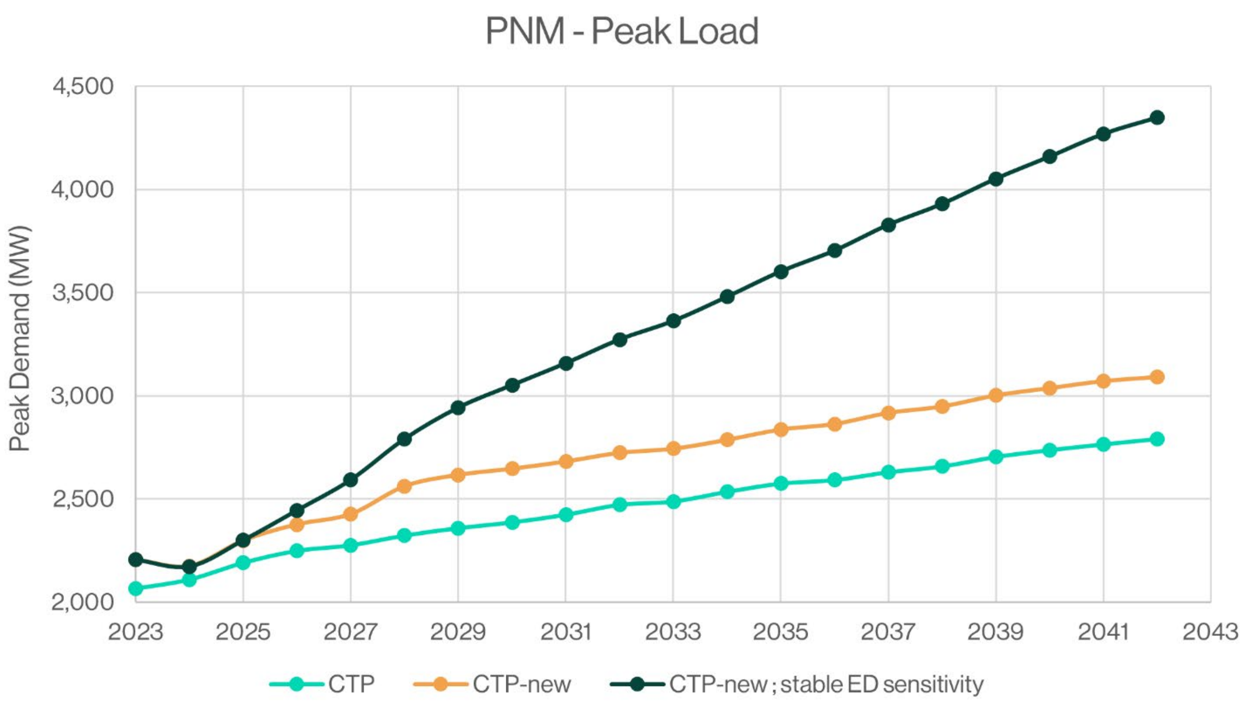

Figure 19. PNM's peak load under the Current Trends and Policy (CTP) forecast in the 2023 IRP and the 2024 Supplemental Update to the 2023 IRP. Also shown for reference is the stable economic development (stable ED) sensitivity modeled in the 2024 Supplement.

Under New Mexico's Energy Transition Act (ETA), PNM must meet an emissions rate standard of no more than 400 pounds per MWh between now and 2031, and no more than 200 pounds per MWh between 2032 and 2040.[130] Starting in 2045, PNM's generation must be zero-carbon.[131] In addition, PNM has a stated corporate goal of being carbon-free by 2040.[132] Because the ETA imposes an emissions rate standard, higher annual energy demand results in increased emissions, unless PNM over-complies with the standard. While PNM considers the New Current Trends and Policy scenario the base case, if load follows the New High Economic Growth scenario, PNM will see even greater energy demands and emissions. Under the New High Economic Growth scenario, PNM would emit an additional 3 million tons of greenhouse gas emissions over the planning period.[133]

[130] § 62-18-10(D) New Mexico Statutes Annotated 1978.
[131] § 62-16-4(A)(6) New Mexico Statutes Annotated 1978.
[132] New Mexico Public Regulation Commission Case No. 23-00409-UT, PNM's Integrated Resource Plan for the Period 2023-2042 in Compliance with NMAC 17.7.3.8, page 13 (filed December 15, 2023).
[133] Over the IRP planning period (2023-2042), under the CTP or CTP-New scenario, PNM will emit roughly 15 million tons of GHGs. Under the HEG-New scenario, PNM projects it will emit approximately 18 million tons, or 20% more, over that same period. NM PRC Case No. 23-00409-UT, PNM's Integrated Resource Plan for the Period 2023-2042 in Compliance with NMAC 17.7.3.8.

Salt River Project (SRP)

Salt River Project (SRP) in Arizona completed an Integrated System Plan (ISP) in 2023. Like an IRP, SRP develops and models different scenarios of load growth and resource development.

In the base or Current Trends case, SRP models an annual growth rate in energy demands of 3.3%, and a 3% annual growth in peak demands between 2023 and 2035. SRP also modeled a Desert Boom scenario, which has growth rates of 4.8% in annual energy demands, and 4% in peak demands.[134] At the time the ISP was developed, the Desert Boom scenario was not specifically tied to the boom in data centers; it was a broader hypothetical scenario tied to regional energy, technology, and manufacturing growth in Central Arizona. However, in early 2025, staff indicated that SRP's current growth projections are following the Desert Boom scenario, rather than the Current Trends scenario.[135] This is largely due to demand from data centers. Specifically, in early 2025, SRP presented the following forecasts:

- Annual energy demands are forecast to have a compound annual growth rate (CAGR) of 6% over the 2024-2035 period, compared with a CAGR of 3.3% in the 2023 ISP. As a result, total energy demand is now projected to be 30% (14,000 GWh) higher in 2035, compared with the previous forecast (Figure 20).[136]

- Peak demand is forecast to grow at a CAGR of 4.2% over the 2024-2035 time period. Between 2025 and 2035, SRP projects its large customer load will grow by approximately 2,700 MW. Of this, roughly 2,200 MW of new load is attributed to data centers, and nearly 500 MW is attributed to advanced manufacturing.[137] SRP's overall peak demand is now projected to be approximately 1,000 MW higher in 2035 than under the Current Trends scenario developed in 2023 (Figure 21). Note that the recently developed forecast reflects a delay in the development of some large, advanced manufacturing projects in the near term, which is counterbalanced by the growth in data center demands over the longer term.

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[134] SRP, "SRP's Integrated System Plan: Scenario Narratives," February 2023. **https://www.srpnet.com/assets/srpnet/pdf/grid-water-management/grid-management/isp/SRP-ISP-Scenario-Narratives.pdf**

[135] Jed Cohen and Mary Faulk, professional communication, April 3, 2025.

[136] SRP Power Committee, "Final Load Forecast for Financial Plan 2026," Naff, M., January 2025. **https://www.srpnet.com/assets/srpnet/pdf/about/governance-leadership/district-meetings/20250123_Power_packet.pdf**

[137] *Id.*

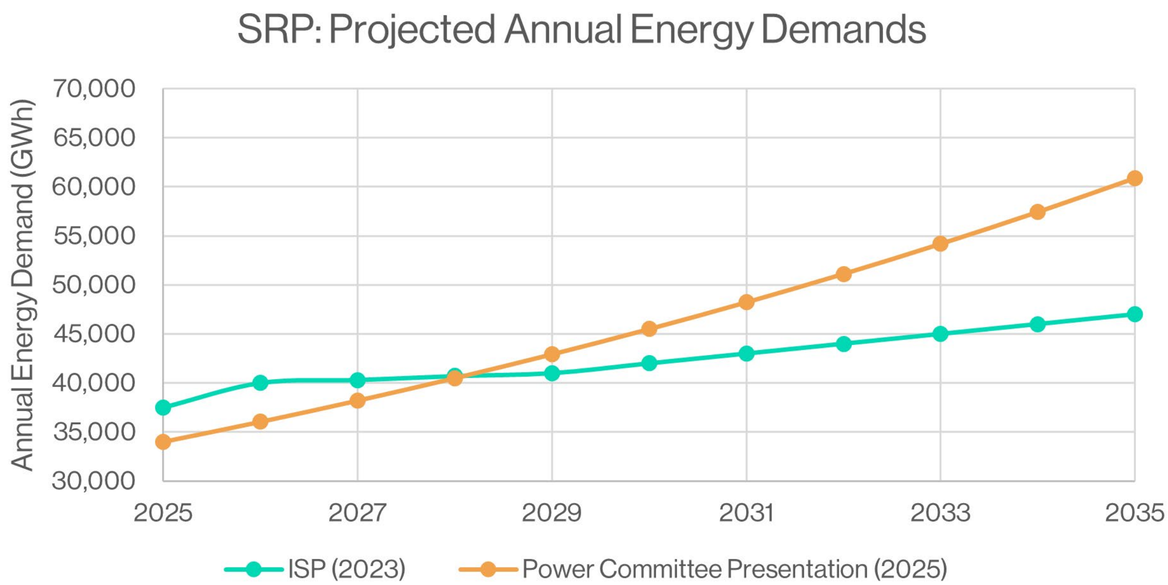

Figure 20. Projected annual energy demands in SRP's 2023 ISP (Current Trends scenario) and estimated future demands based on SRP's presentation to its Power Committee in January 2025.

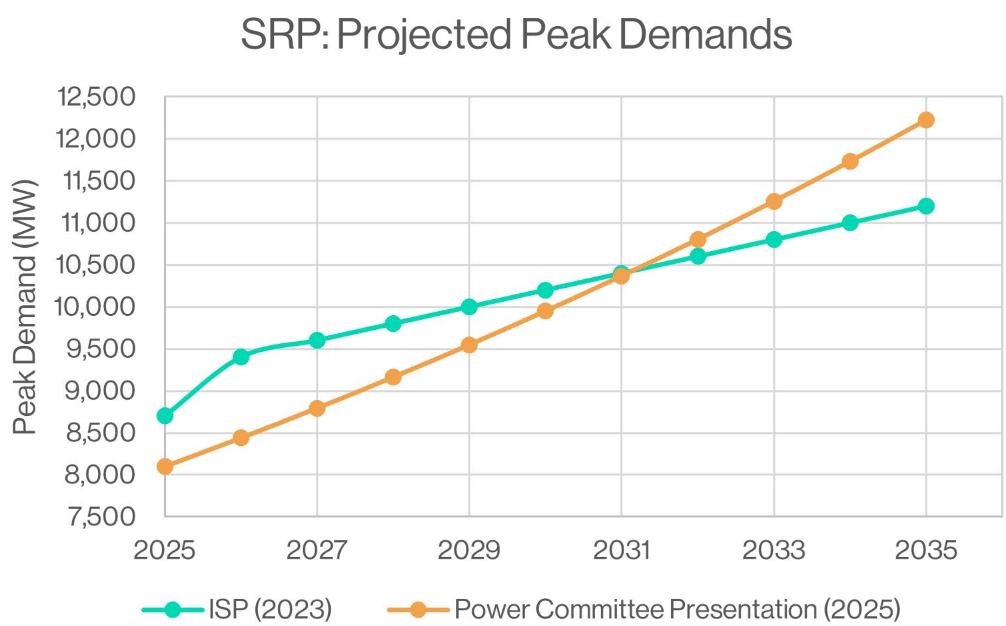

Figure 21. Projected peak demands in SRP's 2023 ISP (Current Trends scenario) and estimated future demands based on SRP's presentation to its Power Committee in January 2025.

The additional load growth has clear implications for SRP's emissions trajectory and demand for new future fossil resources. In the ISP, the utility models three technology-based sensitivities for each scenario: a technology neutral, no new fossil, and minimal coal sensitivity. The no new fossil sensitivity prevents the model from selecting any new fossil gas capacity, and the minimal coal scenario retires all SRP's existing coal capacity by 2035. Under the Desert Boom scenario, with SRP's modeling assumptions, neither the no new fossil nor the minimal coal scenario meets SRP's reliability requirements of a 16% planning reserve margin. In this analysis, WRA does not opine on SRP's underlying modeling assumptions or the ability for policy measures, such as the development of regional energy markets, to enable SRP to meet the higher loads with clean resources. However, the ISP's findings underscore the potential impact of higher loads in SRP's jurisdiction.

Tri-State Generation and Transmission

Tri-State Generation and Transmission serves member electric distribution cooperatives across Colorado, New Mexico, Wyoming, and Nebraska. Tri-State's most recent Electric Resource Plan (ERP),[138] filed in 2023, does not project significant new loads, compared with its 2020 ERP.[139] However, several factors may mask any potential load growth due to data centers.

First, between Tri-State's 2020 ERP and its 2023 ERP filing, several member cooperatives announced their departure from Tri-State's system. This includes United Power, which was Tri-State's largest member cooperative and accounted for over 25% of Tri-State's Colorado sales.[140] Second, Tri-State increased the ability of its member cooperatives to self-generate electricity, further reducing Tri-State's load.[141] And third, Tri-State's 2023 ERP, filed in December 2023, predates the explosion of energy demands and interconnection requests due to data centers and AI.

In its 2023 ERP proceeding, Tri-State included a modest level of new large commercial loads in its ERP load forecast, which was based on information provided by its members. In a response to discovery in May 2024, Tri-State stated that its load forecast includes 65 MW of new large, unspecified customer load in 2030, and 103 MW of new large customer loads in 2035.[142]

It is possible these loads are related to new data centers; however, given their modest size and the timeline when Tri-State's load forecast was developed (prior to December 2023), WRA expects they likely do not include any data centers. However, a recent report provides conflicting information, noting that Tri-State has received interconnection requests for approximately 2,000 MW of new data center loads.[143] It is unclear whether those loads have materialized since Tri-State's responses in May 2024, or if they simply are not included in Tri-State's load forecast.

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138 Colorado Public Utilities Commission Proceeding 23A-0585E.
139 Colorado Public Utilities Commission Proceeding 20A-0528E.
140 The Denver Post, "United Power electric cooperative cuts cord with Tri-State wholesale power provider," April 2024. **https://www.denverpost.com/2024/04/28/united-power-leaves-tri-state-power-provider/**
141 Tri-State, "Tri-State's innovative Bring Your Own Resource program accepted by federal regulators," August 2024. **https://tristate.coop/tri-states-innovative-bring-your-own-resource-program-accepted-federal-regulators**
142 Colorado Public Utilities Commission Proceeding No. 23A-0585E; Tri-State response to discovery WRA 5-3.
143 Southwest Energy Efficiency Project, "Data centers: Power needs and clean energy challenges," Kolwey, N. and H. Geller, March 2025. **https://www.swenergy.org/wp-content/uploads/SWEEP-data-center-report-2025_3_27.pdf**

Tucson Electric Power Company (TEP)

Tucson Electric Power Company (TEP) filed its last IRP in August of 2023, predating the surge in data center demands. However, TEP reported that the utility has received over 10,000 MW of interconnection requests.[144] As of early 2025, the utility is developing contracts for 300 MW of new data center load, which could come online starting in 2027, relying on existing and planned capacity.[145] TEP stated that "at full production, a 300-MW high load factor customer would increase retail sales by about 20%."[146]

The utility expects negotiations with additional customers representing approximately 600 MW of new load requesting interconnection in the 2030 time frame.[147] The 2025 and 2030 additional load projection is shown in Figure 22. This incremental, additional load would require new transmission and generation investments. Assuming the new data centers operate at a load factor[148] of 85%, WRA estimates that TEP's peak demand could increase by approximately 20% in 2027, when the first data center comes online, and 60% in 2030, when the second wave of data centers come online (Figure 23).[149]

From a load forecasting and investment perspective, TEP noted that prior to including new data center loads in its IRP load forecast and investment plans, the utility would expect to have contracts and financial commitments in place demonstrating the customer's commitment.[150]

[144] Fortis, "Q4 2024 Earnings Call Transcript," February 2025. **https://docs.publicnow.com/viewDoc?filename=40898%5CEXT%5CEFC119160EF052D776EF04788FED6F90E06451D8_BC6933EE57717E3A9B3883113368959B974F75E9.PDF**

[145] Fortis, "Q4 2024 Earnings Call Transcript," slide 8, February 2025. **https://www.fortisinc.com/docs/default-source/investor-presentations/fts-q4-2024-call-slides_final.pdf**

[146] *Id.*

[147] *Id.*

[148] *Id.*

[149] Our analysis assumes that the 300 MW of data center load customers do not have a load ramp period and are operating at full capacity beginning in 2027 and that the full 600 MW of additional data center customers come online in 2030 and are operating at full capacity.

[150] Professional communication with Michael Sheehan, March 20, 2025.

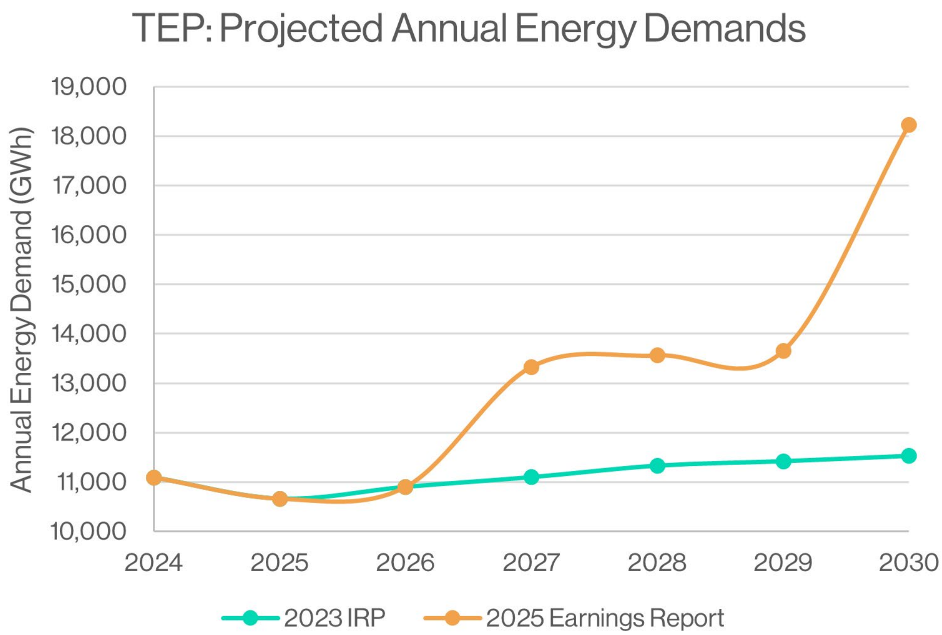

Figure 22. TEP's projected annual energy demands under the 2023 IRP and updated with information from the 2025 Earnings Report.[151]

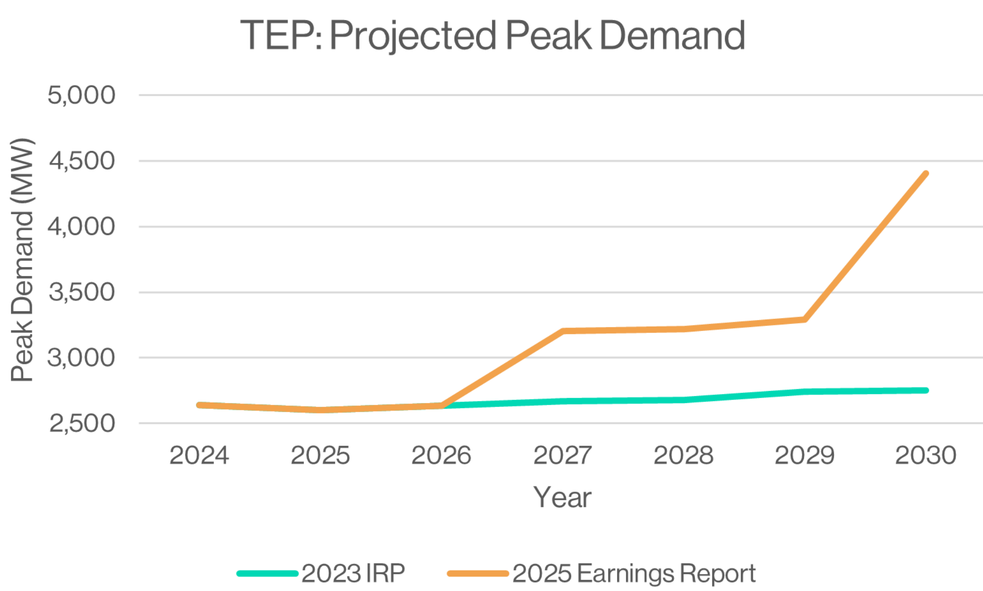

Figure 23. Projected changes in TEP's peak demand. The graph shows the load forecast from the 2023 IRP and amended to include data center loads noted in the February 2025 Fortis investor earnings call.[152]

[151] The 2023 IRP projections go through 2038, where they estimate 13,233 GWh of demand. For the 2025 Earnings Report projections, we assume that the 300 MW of data center load will materialize entirely in 2027 and that the additional 600 MW of data center load will materialize in 2030. These assumptions do not account for potential load ramping of these loads. In addition to those loads, we incorporate the growth projected in the 2023 IRP.

[152] This graph assumes that peak demand will increase proportionately to annual energy demands.

VII. Glossary

Acre-foot: A measurement of water quantity. One acre-foot is equal to approximately 326,000 gallons of water and is enough to provide water for approximately six to nine people per year.

Adiabatic cooling systems: Data center cooling systems that use water to cool air that is circulated in the data center. For example, water may be sprayed to precool air circulated in the data center, or air used in the refrigeration compressor unit. Adiabatic cooling systems are analogous to a "swamp cooler" in residential and commercial buildings. Also known as direct evaporative cooling systems.

Ancillary services: Services that ensure reliability and support the transmission of electricity from generation sites to customer loads. Such services may include load regulation, spinning reserve, non-spinning reserve, replacement reserve, and voltage support.

Bad harmonics: Power quality fluctuations that exceed industry limits, like distorted frequency or voltage levels.

Behind-the-meter clean resource (BTM clean resource): Zero-emission energy generation and/or storage resources that are located on the customer's side of the electricity meter. A majority of the energy created by a behind-the-meter clean resource is used to meet the customer's on-site energy needs, thereby reducing consumption from the utility's broader system.

Beneficial electrification (BE): Replacing direct fossil fuel use — like propane, heating oil, and gasoline — with electric alternatives in a way that reduces overall emissions and creates other cost or grid impact benefits.

Bundled utility service: A means of operation whereby energy, transmission, and distribution services, as well as ancillary and retail services, are provided by one entity.

Clean transition tariff (CTT): Regulator-approved programs in which a large load customer provides financial backing for the utility to develop or procure a clean generation resource and the utility then sells the resource's electricity to the contracted customer. The customer commits to paying for the incremental up-front costs of procuring the resource, if any, as well as the electricity costs. The customer makes a long-term commitment to purchase the resource's supply, spanning from multiyear commitments to the full lifetime of the resource.

Combined cycle gas plant: A methane gas electric generating unit with both gas and steam turbines, where the waste heat from the gas turbine is recovered and produces additional electricity in the steam turbine.

Compound annual growth rate (CAGR): The mean annualized growth rate for compounding increases over a given time period.

Cost allocation: The methodology through which the full suite of costs incurred to operate the utility's electric system are divided up between different classes of customers, such as residential, small commercial, and large commercial.

Cross-subsidies: When one customer class subsidizes another through the rate setting process by overpaying or underpaying the actual system costs incurred to serve that customer class.

Curtailment: The reduction or limitation of energy that could otherwise be generated due to grid congestion, grid imbalances, or grid stability risks.

Demand charges: A charge on electricity bill that reflects the highest rate of energy consumption, on a capacity or MW basis, during a specific period, typically a 15-minute interval.

Demand response: A change in an electric utility customer's consumption undertaken to better match the demand for power with the supply.

Distribution infrastructure: Components of the broader electricity grid originating at a distribution substation and including the lines, poles, transformers, and other equipment needed to deliver electricity to a customer at the required voltages.

Dry cooling: See *refrigeration cooling.*

Economic development rate (EDR): A special electricity rate that offers reduced pricing for certain large customers of electricity, typically under the assumption that the large electricity demands of the customer receiving the economic development rate will support a large new workforce and contribute significantly to the local tax base. Economic development rates are typically established by state statute or regulation and have specific conditions for approval.

Economizer: Part of a building's HVAC system that uses cool outdoor air or water to cool the building instead of operating the air conditioning compressor.

Energy park: Geographic areas with multiple renewable energy and energy storage resources colocated with one or more large energy customer, all of which are connected to the broader electricity grid at a single point.

Energy storage: Energy storage systems use electricity — or some other energy source, like solar-thermal energy — to charge an energy storage system or device, which is then discharged to supply electricity when needed at desired levels and quality. Examples of energy storage technologies include batteries, pumped hydroelectricity, and compressed-air storage.

Free-cooling: A cooling system that takes advantage of outdoor ambient air or water temperatures to cool the air that is circulated in a data center. An air-side economizer can circulate outdoor air in the data center during the times of the day or year when the ambient humidity and temperature is low. Similarly, a water-side economizer may use a river, lake, or ocean to cool air that is used in a refrigeration system compressor or circulated through the data center. Free-cooling systems can reduce the overall energy needed to cool a data center.

Generation resources: Components of the broader electricity grid that generate electricity that is then transmitted to customers through the transmission and distribution systems. Generation resources include both zero-emission technologies like wind, solar, and geothermal, as well as fossil fuel technologies that combust fossil gas or coal to generate electricity.

Gigawatt (GW): A unit of electric power equal to 1 billion watts. For a sense of scale, the U.S. has approximately 1,300 GW of total generation capacity.

Gigawatt hour (GWh): A unit of electric energy equal to 1 billion watt-hours. One GWh is enough to power about 1.1 million homes for an hour or 300 million cell phone charges.

Groundwater: Water that exists underground in the soil or in pores and crevices in rock.

High load factor: A characteristic of a certain electricity customer who demands relatively consistently high levels of electricity from hour to hour, day to day, and month to month.

Hyperscale: A very large data center designed to handle large-scale workloads. Hyperscale data centers are typically 10,000 square feet or larger.

Integrated resource plan (IRP): A process through which electric utilities forecast future electricity demand and assess an array of demand- and supply-side resources capable of meeting that anticipated demand.

Interconnection: The process through which electricity customers connect to the grid and establish the provision of electricity service from the relevant utility.

Kilowatt: A unit of electric power equal to 1,000 watts.

Kilowatt hour (kWh): A unit of electric energy equal to 1,000 watt-hours.

Liquid cooling: A cooling system that directly absorbs heat from computer components, rather than cooling the air around the computers. Liquid-cooling systems may immerse the computer equipment in a fluid like water, glycol, or specialized coolants, transferring heat from servers, enabling a higher temperature set point for the data center. This makes the data center more energy- and water-efficient. Liquid cooling is well suited to energy-dense technology equipment such as AI data centers; while it is an emerging technology, it is increasingly being used by AI data centers.

Load: A generalized term for electricity demand.

Load forecasts: A utility's projection of future load growth, typically informed by historical data, current trends, and future projections.

Load growth: Increases in demand for electricity over time.

Load interruption: The temporary disconnection of an electrical load from the power supply. Load interruption can be undertaken voluntarily through programs or tariffs that compensate the customer for the adjustment in service.

Load shape: The distribution of demand for electricity as measured over time. Individual customers have load shapes, which can be aggregated into more holistic system load shapes.

Load shifting: An energy management strategy that involves moving energy consumption from peak demand periods to off-peak periods, without necessarily reducing the total amount of energy used.

Managed charging: An adaptive means of charging electric vehicles that considers both vehicle energy needs and broader grid needs, typically designed to provide grid support or mitigate the impacts of EV charging.

Marginal cost: The cost of supplying an additional unit of electricity to the electrical system, often measured in MWhs or kWhs.

Megawatt (MW): A unit of power equal to 1 million watts.

Megawatt hour (MWh): A unit of electric energy equal to 1 million watt-hours.

Microgrid: A group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid.

Peak demand: The period when electricity demand is highest.

Potable: Water that is safe for drinking.

Power quality: How well electricity delivered to electrical equipment matches the desired characteristics, encompassing a wide range of parameters that impact the performance, reliability, and safety of electrical equipment.

Power use efficiency (PUE): A ratio of the energy used by the data center to the energy used for computing (measured in kWh/kWh). If the PUE is 1, the data center is perfectly efficient — all the energy is used for computing tasks. Higher PUEs indicate lower efficiency, because more energy is used for auxiliary tasks like cooling, lighting, or other on-site processes.

Rate class: A grouping of customers with similar electricity usage patterns and characteristics that are used by utilities and regulators to determine and apply different rates for electricity service.

Ratemaking: The process of determining and establishing rates. In the electric utility context, this is typically undertaken by a designated regulatory body.

Refrigeration cooling: A cooling system in which an air handler circulates cool air in the data center and removes hot air; the hot air is then cooled in a compressor unit using air — an air-cooled chiller (also referred to in this report as dry cooling) — or water, as with a water-cooled chiller.

Sensitivities: Sensitivities are ways to assess how changes in certain input variables affect the output of a modeled system.

Stranded asset: An investment in infrastructure, like a power plant or transmission line, that loses value or becomes a liability before the end of its expected useful life.

Surface water: Water located on the top of land.

Tariff: A pricing structure that establishes how a customer pays for using electricity, typically including terms and conditions for the delivery of energy, rates, charges, and other terms of service.

Time-of-use rate (TOU): A pricing structure where the cost of electricity varies depending on the time of day, week, and/or season. In contrast to standard flat rates, where the price per kWh remains constant, TOU rates aim to encourage energy consumption during off-peak hours when demand is lower or during times of high renewable energy **curtailment**, with the aim of reducing costs and/or reducing emissions.

Transmission resources: Components of the broader electricity grid enabling the bulk transfer of electrical energy from generation resources to distribution infrastructure.

Water use efficiency (WUE): The liters of water per kWh of energy used for computing. Higher WUEs reflect lower efficiency. The water use efficiency can be further broken down into the water used on-site for cooling, and the water used off-site to generate electricity used by the data center.

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