Multiple Benefits of the City of Santa Fe's Water Conservation Program

Municipalities use a substantial amount of energy to deliver and treat water, but exactly how much energy is dependent on many factors, such as the source of water supplies, required treatment, total consumption, topography of the region, and distance the water travels throughout a service area.

The U.S. Environmental Protection Agency's (EPA's) WaterSense® program and the City of Santa Fe, New Mexico, partnered to evaluate this energy-water nexus and determine how many kilowatt-hours (kWh) of electricity it takes to move one acre-foot[1] of water through the water system in the City. This case study provides preliminary results to evaluate how much energy it takes to extract, move, heat, and treat water throughout Santa Fe City limits and to characterize how the City's efforts to reduce water use over the last several decades have saved both energy and money while supporting cost-effective growth in the face of limited water supplies.

Santa Fe's Water System and Energy Use

The City of Santa Fe uses electricity throughout its water system to:

- Extract and convey water
- Treat source water
- Distribute water throughout its service area
- Collect and treat wastewater

The City is able to extract water from four sources: surface water from the Santa Fe River; surface water diverted from the Colorado River to the Rio Grande and pumped by the City via the Buckman Direct Diversion (BDD); groundwater from deep wells (up to 2,000 feet deep) in the Buckman Wellfields; and groundwater from the City Wellfields. This diverse set of water resources ensures the City has reliable water both now and in the future, but also consumes a great deal of energy in the supply and treatment process.

The City operates two water treatment plants—BDD Water Treatment Plant (BDDWTP) and Canyon Road Water Treatment Plant (CRWTP)—and one wastewater treatment plant, the Paseo Real Wastewater Reclamation Facility (PRWRF). Some treated wastewater is used for irrigation at parks and golf courses, while the rest is discharged back to the Santa Fe River. Long-term plans call for indirect water reuse to

[1] An acre-foot of water is equal to 325,851 gallons.

832-F-26-008
June 2026

further expand available supply. By returning reclaimed water back to the Rio Grande, the City will be able to withdraw additional water from BDD to supply water for customers.

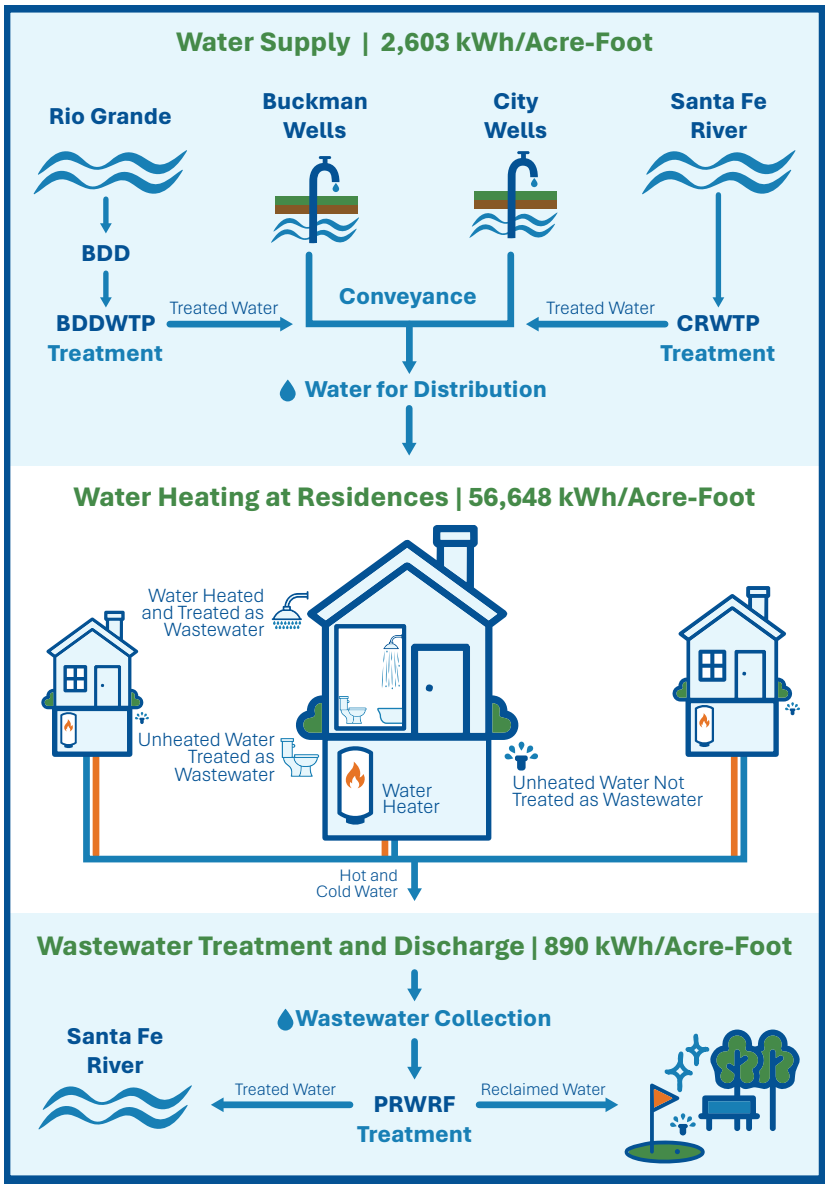
Extraction and treatment make up the bulk of the water and wastewater system's energy use. Although the City relies mostly on gravity to deliver water to and wastewater from homes and businesses, electricity is also used by booster pumps and lift stations to help deliver water to storage tanks (often at higher elevations) and move water throughout the City. Pressure-reducing valves are used throughout the system to maintain desired service pressure and effectively remove energy from the system. In addition, homes and businesses consume energy to heat water for end uses such as showering, washing, and other domestic uses.

Evaluating Energy Intensity for Supply, Use, and Treatment

A working group formed in 2024 by EPA, the City of Santa Fe, and other partners evaluated the energy intensity of each phase of the City's water system. The following data were used as primary inputs across a 2021 to 2023 study period:

- Electric meter data from the City's electricity supplier, Public Service Company of New Mexico (PNM), for more than 70 metered locations associated with the City's water system.
- Monthly water production data by source.
- Average water use by City customers in gallons per capita per day (GPCD).
- City of Santa Fe residential customers' home and irrigation system water meter data to estimate how much water is used outdoors versus indoors.
- Water end use data predictions from the Green Builder® Coalition's Water Efficiency Rating Score (WERS)®.
- Local weather and climate data to help estimate water heating requirements.
- Census data on Santa Fe housing and population.

FIGURE 1. ENERGY INTENSITY AT VARIOUS PHASES OF SANTA FE'S WATER SYSTEM



The study found that the City of Santa Fe uses approximately 24.6 million to 32.5 million kWh per year to supply customers with water and treat wastewater. At the average 2023 commercial rate for electricity in New Mexico of $0.1068 per kWh, powering the City's water system costs about $2.6 to $3.5 million per year.

Using the primary data sources listed above, EPA estimated the average energy intensity in kWh per acre-foot of the various phases of the City of Santa Fe's water system during the study period: water supply (including extraction, conveyance, treatment, and distribution); water heating at residential households;[2] and wastewater treatment (including collection and discharge). Figure 1 and Table 1 display these results.

Because few municipalities have conducted similar analyses, it is challenging to determine how the energy use of Santa Fe's water system compares to other municipalities. However, EPA was able to compare the estimates for Santa Fe to its previous study in two WaterSense labeled home communities in Menifee, California,[3] and an available conservative nationwide estimate.[4] Table 1 provides these data.

TABLE 1. ENERGY INTENSITY OF VARIOUS PHASES OF WATER SYSTEMS

Phase	Santa Fe, New Mexico	WaterSense Labeled Homes Communities in Menifee, California	Conservative National Estimate
Water Supply (kWh/acre-foot)	2,603	1,824	674
Wastewater Treatment and Discharge (kWh/acre-foot)	890	721	800
Water Heating at Residences (kWh/acre-foot)	56,648	8,616	54,720

Compared to both the WaterSense labeled homes communities in Menifee, California, and the nationwide estimate, the City of Santa Fe uses more electricity to deliver water to customers. The variable topography of Santa Fe plays a large part in this number, resulting in high energy intensity values for pumping water extracted from BDD, which must be elevated 1,100 vertical feet over 11 miles to reach the BDDWTP. In addition, sourcing groundwater is also energy-intensive.

The energy intensity for wastewater treatment and discharge is similar among Santa Fe, Menifee, and the nationwide estimate, likely because the energy needed to treat and discharge wastewater isn't as variable by topography and water source (assuming the primary source of wastewater is municipal sanitary sewers). The energy intensity for residential water heating in Santa Fe is similar to the nationwide estimate for the same reason. Energy used for water heating in Menifee is much lower due to the use of highly efficient water heaters and should be considered an outlier in this analysis.

[2] Because this study focused on residential water consumption, EPA only estimated energy use from residential water heating in this analysis. EPA did not estimate energy use from heating water at Santa Fe commercial, institutional, and industrial customers in this case study due to data availability.

[3] EPA's WaterSense program. February 2024. *WaterSense Labeled Homes Communities Save Energy and Support Decarbonization*. www.epa.gov/system/files/documents/2024-03/ws-labeled-homes-menifee-commmunities-case-study.pdf.

[4] Electric Power Research Institute (EPRI) and Water Research Foundation (WRF). November 2013. *Electricity Use and Management in the Municipal Water Supply and Wastewater Industries*. www.epri.com/research/products/000000003002001433.

The City of Santa Fe has added solar arrays to offset energy use from many parts of its water system and is continuing to focus on the energy efficiency of the water systems. Although these energy sources were not submetered in this analysis, they significantly reduce the grid-supplied energy intensity of the system. These as well as additional projects (such as power generation from bioreactors at the PRWRF) will continue to reduce Santa Fe's system-wide energy intensity.

Characterizing Energy and Cost Savings

Located in the drought-prone high desert of New Mexico, the City has made reducing per capita water use part of its population growth strategy for more than two decades. Since 2000, the City's GPCD value has dropped nearly 30 percent—from 137 GPCD in 2000 to 98 in 2023.[5] In fact, the total amount of water produced in 2000 is nearly equivalent to the amount produced in 2023, even though the City's population has increased by about 40 percent over the same time period.

To achieve this, the City has operated robust residential and commercial water conservation programs, implemented requirements for water-efficient new construction, and maintained an aggressive education and outreach campaign to create an ethos of conservation to contribute to these successes. The City's efforts have not only saved water; they have saved energy and operating costs, as well as infrastructure spending that would have been needed to meet higher water demand.

Water-Efficient New Construction Contributes to Savings

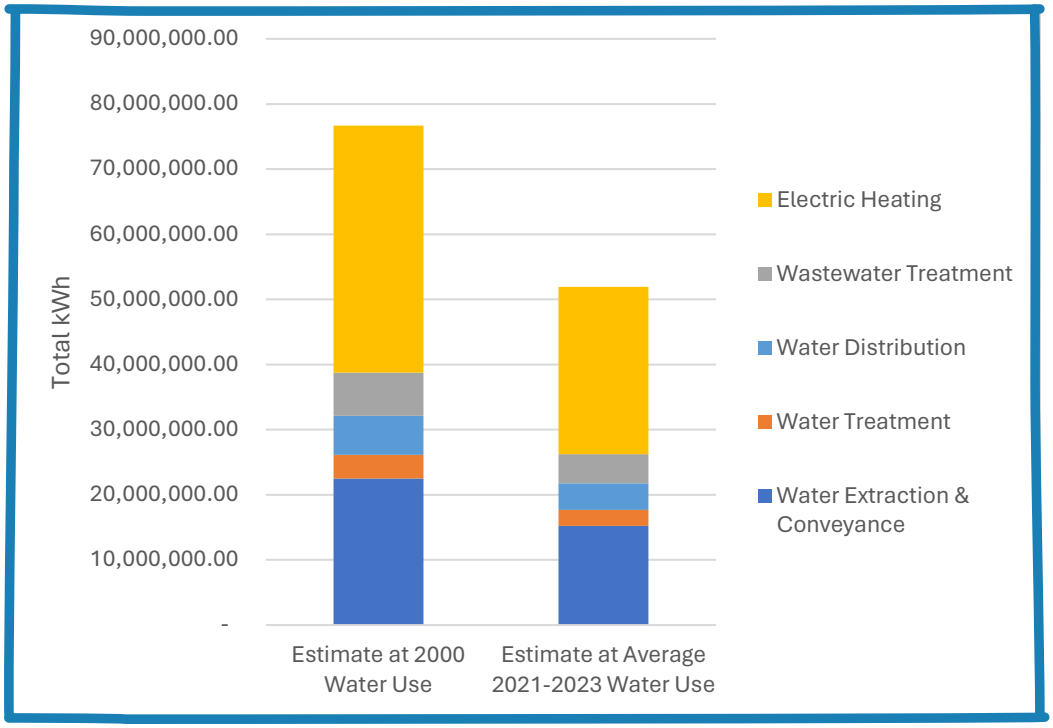
Encouraging and promoting water-efficient new construction is one way to stretch water resources while meeting housing demands. EPA's WaterSense labeled homes program requires that certified homes use 30 percent less water than typical new construction. In the City of Santa Fe residential building code, new homes are required to achieve a WERS of 70 or lower. Homes that meet a WERS of 66 or lower can also earn the WaterSense label. To learn more about the WaterSense labeled homes program, visit www.epa.gov/watersense/homes.

Over the study period, homes in the City used approximately 8,400 acre-feet of water. At 2000 GPCD consumption levels, the City's homes would have used about 11,500 acre-feet of water. Assuming the average energy intensity of delivered and treated water in this study (3,493 kWh per acre-foot), the City uses an estimated 12.5 million kWh per year less energy to supply and treat water for residential customers than it would if it had maintained water use at 2000 levels. As a result, at current commercial electricity rates, the City is avoiding about $1.3 million per year in electricity costs, just by reducing water use. Accounting for energy used for water heating at all residences in Santa Fe, the City has further reduced water-related energy use by approximately 12 million kWh of electricity and 250,000 Mcf of natural gas annually, compared to the energy it would have used if it maintained water-use levels from 2000. As opposed to system savings, which directly benefit system/municipal bills that are ultimately passed on to residents and rate payers, savings from reduced water heating directly benefit consumers. Figure 2 illustrates this water-related electricity savings. Note that natural gas savings from reduced water heating requirements are not displayed.

[5] City of Santa Fe. 2024. *City of Santa Fe Water 2024 Annual Report*. https://santafenm.gov/media/files/public_works/SantaFe2024AnnualReport.pdf.

It is worth noting that applying the estimated of 3,493 kWh per acre-foot to higher water consumption values from the year 2000 likely understates the energy savings. This is because increasing water production within the system would result in reliance on higher energy intensity sources (such as the BDD and Buckman wells), thereby increasing the average intensity of the system. In addition, the energy use is impacted by the City's significant investment in off grid power, so the purchased electricity is considerably lower. Any energy required for additional water production would rely on grid-supplied energy only.

FIGURE 2. COMPARISON OF RESIDENTIAL WATER-RELATED ENERGY USE ESTIMATES FOR SANTA FE AT 2000 AND 2021-2023 AVERAGE WATER USE LEVELS



This study illustrates how the City's water conservation efforts have paid off in more ways than one. By focusing on water efficiency, the City produces a consistent volume of water despite population growth, and also avoids significant energy use and utility costs. By continuing to push water efficiency, the City will continue to avoid over-reliance on higher energy intensity sources.

Acknowledgements and Next Steps

EPA would like to thank Jesse Roach, Christine Chavez, Patricio Pacheco, and Caryn Grosse from the City of Santa Fe; Santa Fe City Councilor Carol Romero-Wirth; Holly Cannon and Robbie Pickering from ERG; Doug Pushard from KUELWater; Mike Collignon and Laureen Blissard from GBC; and Josh Romero and Manuel Quintana from PNM for their support during this study.