

Responsible Water Use for Electric Generation

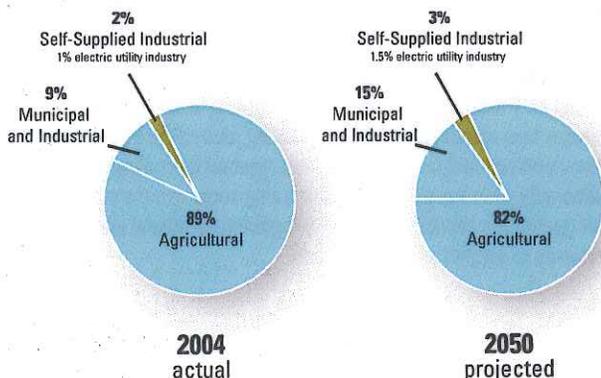
Most of Xcel Energy's Colorado generating stations use water to cool equipment used to generate electricity. Water is essential to the process. In addition, we have five small hydro electric stations in Colorado that use river flows to generate electricity and a pumped-storage hydro electric station.

The Colorado Water Conservation Board last assessed water usage in the state in 2004. At that time, 2 percent of Colorado's water usage was used in the self-supplied industrial category, which includes the electric utility industry as well as snowmaking, sand and gravel and other large industries. The electric utility industry makes up approximately half of the category. The Water Board's projection for water usage in 2050 shows that water use for electric generation does not increase significantly, and continues to represent approximately half of the self-supplied industrial category.

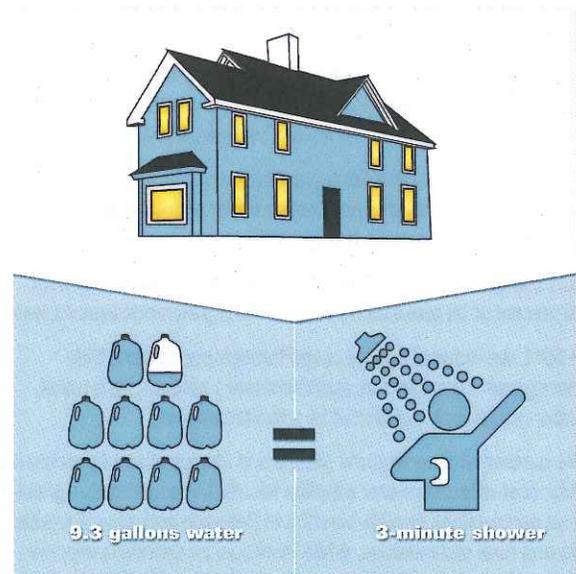
While Colorado's electric utility industry consumes less than 2 percent of the state's water, it provides an essential service that is inextricably tied to our economy. Xcel Energy provides electricity for 1.4 million customers in 31 counties throughout the state.

Average household electricity usage per day

Water use in Colorado



Source: Colorado Water Conservation Board



Typical electricity usage for one house (682 kWh/mo, Xcel Energy customers) requires approximately 9.3 gallons of water per day at our facilities, based on the fleet's system average water usage (410 gallons/MWh). This is equivalent to a three minute shower, or less than 6 percent of the per-capita daily water (165 gpcd) usage reported by Denver Water for its customers in 2011.

In our resource plans, we present information to the Colorado Public Utilities Commission regarding the use of water in electric generation. Specifically, we detail our water resources, the costs associated with those resources, and water consumption and intensity by generating station.



Xcel Energy's Water Conservation Efforts

Our water use in Colorado has been relatively flat since 2005. We have implemented water-saving measures in our Colorado operations including:

- Comanche Station's Unit 3 utilizes a low-water use system with hybrid cooling technology. This system provides additional air cooling capability, thus reducing water use on this unit by 30 to 50 percent.
- We use recycled municipal water from the city of Denver in our Cherokee Station. Overall, this recycled water accounted for more than 40 percent of Cherokee Station's water consumption and 8 percent of Xcel Energy's overall Colorado water consumption in 2011.
- After Colorado's Clean Air Clean Jobs Project is implemented, with the retirement of about 600 MW of coal-fired generation, overall system water usage is expected to decrease by approximately 15 percent.
- We employ good stewardship practices at our facilities to minimize water use, including efficient cooling tower operation and on-site water recycling through our plant processes.
- Xcel Energy has nearly 2,200 MW of wind on its Colorado system, 20 percent of its generation portfolio. Wind generation uses no water.
- In 2011, we reduced energy usage through our Demand Side Management programs by approximately 1 percent. As a result, water usage likely decreased by a similar amount.
- We partner with agricultural groups and municipalities to secure reliable, cost-effective water supplies for electric generation. Agricultural partnerships provide benefits to Colorado agricultural producers and rural communities, while municipal partnerships improve both water supply and water quality for their customers.

Types of Cooling Used in Electric Generation

- **Open-loop cooling.** Uses reservoir water to cool and condense the steam used to drive the turbine and generate electricity. Heat transfer to water is very efficient and allows the plant to operate at maximum efficiency, generating the most electricity possible per fuel unit. Heat transfer to the reservoir contributes little to additional evaporation from the reservoir. (Valmont Station)
- **Closed-loop cooling.** Uses water in cooling towers to cool and condense the steam used to drive the turbine and generate electricity. Heat transfer to water is very efficient and allows the plant to operate at maximum efficiency, generating the most electricity possible per fuel unit. Cooling towers require relatively low water volumes to operate efficiently, and they are operated to minimize water usage and provide recycled water for other plant operations. (Arapahoe Station, Cherokee Station, Ft. St. Vrain Station, Rocky Mountain Energy Center, Pawnee Station, Comanche Station – Units 1 and 2, Hayden Station)
- **Hybrid cooling.** Uses both air and water cooling. Air cooling reduces water usage when the ambient air temperature differential is sufficient to support the necessary cooling, but uses water during other times of the year when heat transfer to air is inefficient. Hybrid cooling uses more fuel and produces less electricity than water cooling because of the less efficient steam cycle and additional electric load required by cooling fans. (Comanche Station – Unit 3)
- **Dry cooling.** Uses only air cooling to condense steam. In addition to being very expensive to construct, air-cooling uses more fuel and produces less electricity than water-cooling, due to the less-efficient steam cycle and additional electric load required by cooling fans. Additionally, heat transfer limitations during some months may limit plant generation capacity, potentially requiring additional power purchases to support system demands.