
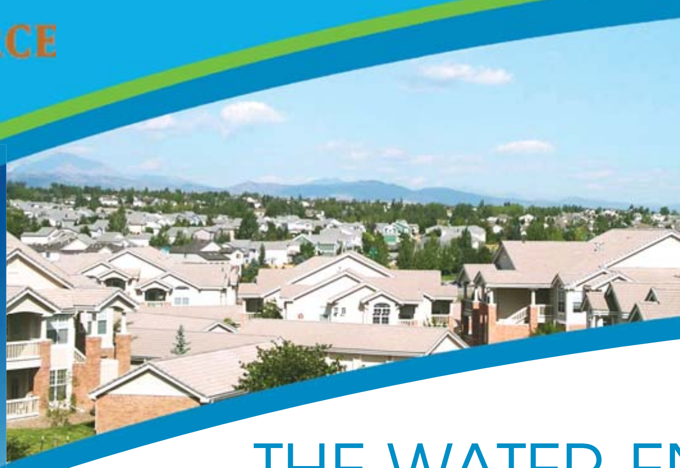


# THE WATER-ENERGY NEXUS IN COLORADAN COMMUNITIES

## MANAGING ENERGY USE IN THE WATER SECTOR

Many local governments are developing plans to reduce their energy and water usage. Most often, these efforts are managed separately. However, energy is embedded in all stages of water use, which creates an opportunity for local governments to work toward both of their goals simultaneously. Water requires energy during the pumping, treating, distribution, heating, and wastewater treatment stages. Thus, every gallon of water saved also saves energy.

The development of new water supplies and new water infrastructure can significantly increase a community's energy demands, and this energy demand should be taken into consideration in municipal water and energy plans. As communities develop and implement their sustainability plans, they have opportunities to find new ways to connect their water and energy programs while meeting their triple (economic, environmental, and social) bottom line. This fact sheet outlines strategies to address energy use in the water sector and highlights some of the Colorado communities that are making the connection today.

### Energy in Water Systems

A study by the River Network estimated that all stages of water use accounts for at least 13% of the nation's electricity,[1] but on a local scale, water and wastewater treatment facilities typically account for 30–40% of municipal energy demands (i.e., from municipal government operations, not community-wide energy demands).[2] Indeed, the city of Fort Collins found that water and wastewater utilities comprised 26% of the city's municipal greenhouse gas (GHG) emissions[3], the city of Golden found that over 30% of its annual energy costs were for water pumping and treatment,[4] and the city of Carbondale found that its wastewater treatment plant was the single largest energy user in their government's portfolio.[5]

### Best Practices

Ways to Manage Energy & GHG Emissions at Every Stage in the Water Sector

**Source & Distribution**

- Integrate energy demands and GHG emissions of current and future supplies into water resource plans.
- Evaluate incremental energy use of recycled water.
- Fix leaks, paying attention to those that are the most energy-intensive.

**Water & Wastewater Treatment**

- Measure and manage energy usage at treatment facilities in real time.
- Install energy efficiency upgrades.
- Install renewable energy sources.

**End Use**

- Develop partnerships between energy and water utilities.
- Integrate water conservation into building codes.
- Expand outreach to renters and homeowner associations.

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## Ways to Save

### Source & Distribution

Although some communities in Colorado get their water from gravity-fed sources, others pump it from distant locations or deep aquifers which require significant amounts of energy. Many communities do not consider the energy demands of water sources in their sustainability plans. WRA recommends that communities:

***Integrate energy demands and GHG emissions of current and future supplies into water resource plans.*** The energy use of new supplies should be considered not only for cost but also for its contribution to energy demands and associated GHG emissions. For example, Colorado Springs Utilities and Denver Water became members of The Climate Registry to measure their GHG emissions as a first step in understanding how to target energy and emissions reductions. There are many important factors to consider when adopting new water supply strategies, and energy demands should be one of them.

***Evaluate incremental energy use of recycled water.*** Depending on the system, recycled water may not require significant additional treatment beyond current discharge requirements—when compared to imported water or deep groundwater sources, it might be less energy-intensive. Recycled water can be used for direct re-use—often providing water for irrigation of parks, golf courses, lawns, and other landscaped areas—or indirect re-use, where treated water is released to a stream and the same volume is diverted elsewhere. Parts of Colorado have already implemented various forms of water re-use, including Aurora, Denver, Westminster, and Arapahoe County. Aurora's Prairie Waters project is direct potable re-use—perhaps the first of its kind, and certainly of its scale, in the state.

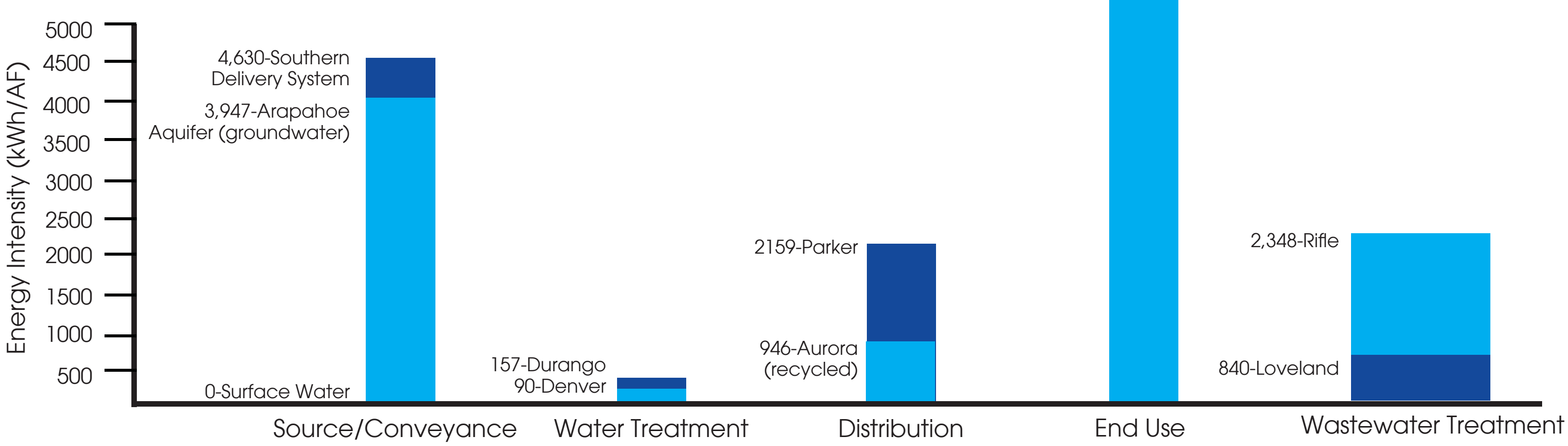
***Fix leaks, paying attention to those that are the most energy-intensive.*** Perhaps the most effective way to reduce energy use and GHG emissions in the distribution stage is by fixing system leaks. Water that is lost carries with it all the energy that it took to get it there (from the source, treatment, and distribution stages), so saving water will truly save energy. Aspen launched an aggressive main pipe leak detection program, which played an important role in reducing its water use to just 25% of its record high usage.[7]

Energy used to heat water in a home typically accounts for 20% of total home energy use.

Source: U.S. Energy Information Administration

**Figure 1: Energy Intensity of Water System Stages**

The energy requirements at each stage of the water system vary widely depending on the source of water, the regional topography, and the specifications of the treatment plants. This figure shows examples of the energy-intensity of water in each stage, throughout Colorado.[6] Note that the heating of water by end users is so energy-intensive, it is literally off the chart, using 50,000 kilowatt-hours (kWh) of energy per acre foot (AF) of water.



## Water and Wastewater Treatment Facilities

Municipal water utilities know that their energy demands are significant, and so managers tend to run their operations efficiently to minimize costs. However, older infrastructure, older technology, and lack of data can undermine those efforts. Newer energy management methods have proven to be effective at reducing demands in many treatment facilities:

***Measure and manage energy usage at treatment facilities in real time***. "Measure to manage" is an adage familiar to many resource managers, and energy use data at a treatment facility is crucial for effective operations management. The Consortium for Energy Efficiency found that conservation measures in water and wastewater treatment facilities typically achieve 15–30% savings.[8] The City of Carbondale's wastewater treatment plant began to track its energy use with software that provided measurement of energy use every 15 minutes. Since monitoring began, energy use has decreased 30%, and the plant is on track to further reduce its energy usage.[9]

***Install energy efficiency upgrades.*** The U.S. Environmental Protection Agency (EPA) Region 8 piloted an Energy Performance Contracting program for water and wastewater utilities, which allows for the up-front costs of energy-efficient upgrades to be paid for over time as energy savings are achieved. The City of Loveland was one of 29 water utilities in Colorado selected to participate. Loveland worked with the Governor's Energy Office to select an energy service company to assess the city's entire water system, from the water treatment plant to the pump stations and the wastewater treatment plant. The results from the pilot study are expected in late 2011, but the results could look like the ones achieved in EPA Region 1: the 21 participating pilot facilities in Region 1 are expected to collectively save $5 million dollars, 29 million kW of energy, and 22,000 tons of carbon dioxide annually.[10]

***Install renewable energy sources***. Renewable energy sources that release no GHGs can provide some of the power needed for water and wastewater treatment facilities. The City of Rifle installed a 2.3-megawatt (MW) solar photovoltaic array on its wastewater treatment (WWT) facility and raw water pump station, Boulder installed a 1-MW solar array for its WWT facility, and Durango installed a 40-kW biogas turbine at its.

## End Use

A gallon of hot water saved reduces energy and GHG emissions because it is one less gallon of water that needs to be sourced, distributed, heated, and treated.

Importantly, water conservation is a no-regrets strategy that plays an essential role in resource planning. Cities have expanded their water conservation programs and linked them to traditional energy conservation measures in many ways:

***Develop partnerships between energy utilities and water utilities***. A number of water and energy utilities have partnered to jointly fund rebates on devices that save both water and energy. Aspen's municipal electric utility and water utility jointly fund a number of residential rebates/incentives, including clothes washers, dish washers, and efficient toilets. Local governments that don't have a municipal electric utility can contact their energy provider to explore joint funding opportunities, or have the water utility provide matching rebates on water- and energy-efficient devices currently offered by the electric utility.

Smaller communities may be able to pool resources, or work with a third-party organization that provides assistance with efficiency programs, partnerships, and outreach to a larger area. Many such programs already exist in Colorado: the Community Office for Resource Efficiency (CORE) in Western Colorado, Four Corners Office for Resource Efficiency (4CORE) in southwestern Colorado, Office for Resource Efficiency (ORE) in Gunnison, Garfield Clean Energy in Garfield County, and the Center for Resource Conservation in Boulder County.

These organizations often work with both electric and water utilities, and may be able to provide assistance in bridging conservation programs that operate independently.

***Integrate water conservation into building codes***. Upgraded energy efficiency codes are often an integral part of updating building codes, but it's important to remember that water-efficient devices, such as faucets, showerheads, and toilets, save energy, too.

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The EPA's WaterSense Program has developed standards for these water appliances and for new building construction. Fort Collins is updating its building codes and is considering water and energy efficiency requirements, similar to EPA standards, for new and retrofitted homes and commercial buildings.

***Expand outreach to renters and homeowner associations (HOA's).*** Renters can be a difficult sector to reach. Boulder is in the process of implementing a policy known as "SmartRegs," which will require landlords to install energy- and water-efficient devices in rental units by 2018. The long implementation period, combined with incentives, rebates, and assistance programs, are expected to help landlords make the transition more easily, and increase their property value over time.

Homeowners associations are typically condo units where the common areas are maintained by the HOA, not the individual owners. Residents may be able to reduce their fees to the HOA by asking for water or energy audits of the grounds. Many third-party contractors, like the Center for Resource Conservation, can help to uncover wasteful water or energy practices. In Fort Collins, one HOA conducted a water audit and, after shoring up leaky areas, realized about $10,000 in savings.

## Water-Energy Resources

The water-energy nexus is an emerging issue in the West. Governments are beginning to understand its importance in resource planning, and are starting to proactively address it. The following websites may be valuable resources to sustainability planners:

***Water-Energy Calculator.*** A few free water-energy calculators are available online. One of them, developed by Pacific Institute, can be used to understand the implications of water management decisions on energy consumption and air quality (http://www.pacinst.org/resources/water_to_air_models/index.htm).

***Research & Demonstration.*** The Colorado Water Innovation Cluster, a collaborative effort between academia, local government, and private industry based in Fort Collins, will pilot sustainable solutions for new water supplies. For example, they are investigating commercial grey water re-use and sustainable ag-to-urban water rights transfers (http://www.co-waterinnovation.com). The Water Utility Climate Alliance Resources also has resources about integrating climate change issues into water resource plans (http://www.wucaonline.org/html).

### *Highlighted Programs*

Aurora's Prairie Waters - http://www.prairiewaters.org/
Boulder City SmartRegs Policy - http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=13982&Itemid=22
Center for Resource Conservation - http://conservationcenter.org/
Community Office for Resource Efficiency - http://www.aspencore.org/Community_Office_for_Resource_Efficiency/CORECommunity_Office_For_Resource_Efficiency.html
EPA - http://water.epa.gov/infrastructure/sustain/energyefficiency.cfm
Garfield Clean Energy - http://www.garfieldcleanenergy.org/
ORE - http://www.resourceefficiency.org/
4CORE - http://www.fourcore.org/

## Endnotes

1 River Network. 2009. The Carbon Footprint of Water. Portland, Ore.

2 U.S. Environmental Protection Agency. 2009. Massachusetts Energy Management Pilot Program for Drinking Water and Wastewater Case Study. December.

3 City of Fort Collins, Colorado. 2010. Fort Collins Climate Action Plan - 2009 Status Report. July.

4 Hartman, Dan. 2009. "Management Solutions for Utility Energy Efficiency." Paper presented at U.S. Environmental Protection Agency Region 8's Energy Management Workshop for Water and Wastewater Utilities, Denver, Colorado, October 15. (Hartman is the Director of Public Works in Golden, Colorado.)

5 Romig, Suzie, and Heather McGregor. 2011. "Taking a Closer Look Saves Dollars and Energy at Carbondale Wastewater Plant." Garfield Clean Energy website. Accessed March 25. http://www.garfieldcleanenergy.org/success-stories.html.

6 Specific reference material available from WRA upon request.

7 City of Aspen, Colorado. 2008. Environmental Sustainability Report 2008.

8 Consortium for Energy Efficiency. 2007. Initiative Description: CEE National Municipal Water and Wastewater Facility Initiative. Accessed March 25. http://www.cee1.org/ind/mot-sys/ww/ww-init-des.pdf.

9 Romig, Suzie, and Heather McGregor. 2011. "Taking a Closer Look Saves Dollars and Energy at Carbondale Wastewater Plant." Garfield Clean Energy website. Accessed March 25. http://www.garfieldcleanenergy.org/success-stories.html.

10 U.S. Environmental Protection Agency. 2009. Massachusetts Energy Management Pilot Program for Drinking Water and Wastewater Case Study. December.

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