Water Facts

Water Efficiency Saves Energy: Reducing Global Warming Pollution Through Water Use Strategies

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The collection, distribution, and treatment of drinking water and wastewater nationwide consume tremendous amounts of energy and release approximately 116 billion pounds of carbon dioxide (CO_2) per year—as much global warming pollution each year as 10 million cars.[1] The energy-water connection is particularly strong in the driest regions of the United States, such as the Southwest, where significant amounts of energy are used to import water. Solutions exist to cut both water and energy use. Through water efficiency measures, we can help to protect dry areas from drought, lower consumers' utility bills, and reduce global warming pollution.

The Energy – Water Connection

Providing households with safe drinking water and wastewater disposal is an energy-intensive process. Nationwide, about 4 percent of power generation is used for water supply and treatment, but in certain parts of the United States the number is far higher. California is particularly vulnerable: the water sector is the largest energy user in the state, estimated to account for 19 percent of the total electricity consumed. Reducing water consumption saves energy because less water needs to be treated and pumped to end users. Moreover, when energy use is reduced, water is saved because less is needed in the operation of power plants. Some thermoelectric power plants, for example, use 136 billion gallons of freshwater a day, which translates into 25 gallons of water to produce each kilowatt-hour of electricity.[2]

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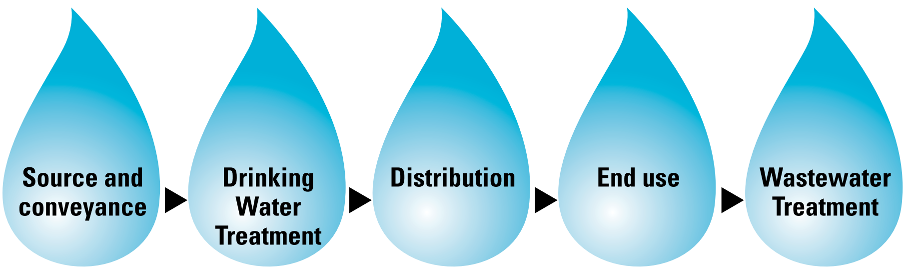
Water conservation and efficiency measures reduce the burden on these energy-intensive water systems. There are ways to cut down on energy use—and greenhouse gas emissions—at every stage in the water process:



NRDC Strategies for Saving Energy Through Water Efficiency

The following series of policy recommendations can help consumers, water suppliers and distributors, farmers, and states conserve water and in turn save energy. In many cases a single investment will help conserve our water supply, protect water quality, and lower energy demand, which also results in economic savings, greater sustainability of our water infrastructure, and a reduction in global warming pollution.

Source and Conveyance

1. Use Low Impact Development ("Green" Building)

Capturing and reusing stormwater runoff can greatly reduce the consumption of imported, potable water, as well as the energy usage and CO_2 emissions associated with importing water. When runoff is diverted and captured before it flows into surface waters, it can be used onsite either to replenish groundwater supplies through infiltration or for graywater uses, like landscape irrigation and toilet flushing. These techniques are known as low-impact development (LID), the central objective of which is to maintain individual sites' pre-development hydrology. LID uses common sense and simple technology—strategically placed beds of native plants, rain barrels, "green roofs," porous surfaces for parking lots and roads, and other measures—to retain rainfall onsite or to help rainfall soak into the ground, rather than polluting the nearest receiving water. In effect, LID mimics nature's own filtration systems. In addition to reducing water and energy use, the result is less water pollution from contaminated runoff, less flooding, replenished water supplies, and often more natural-looking, aesthetically pleasing cityscapes.

Intel's corporate headquarters in Santa Clara, California, incorporates LID techniques.

Case Study: LID Can Save Water and Energy in Southern California

LID's benefits are particularly important in the dry climates that characterize much of the West, where rainfall is in short supply. Southern California, for instance, must import most of its water via the State Water Project, Colorado River Aqueduct, and Los Angeles Aqueduct. Moving such large quantities of water over long distances and significant elevations requires a considerable amount of energy. Widespread use of LID practices would enable Southern California cities to import significantly less water, in turn reducing energy needs and associated CO_2 emissions. As one example, if all new residential and commercial development and redevelopment in urbanized Southern California started using LID practices, by 2030 CO_2 emissions would be reduced by up to 292,000 metric tons per year.

2. Recycle and Reuse Wastewater

Because water suitable for reuse is often a by-product of existing secondary and tertiary wastewater treatment processes, this type of water recycling is a low-energy source of water supply. This is especially true in areas like Southern California, where enormous amounts of energy are required to import water. Recycled water can be delivered to users, usually at less cost than non-recycled water, for anything from irrigating golf courses, parks, and crops, to mixing concrete, to firefighting. In fact, Orange County, California now uses advanced treatment technologies to purify wastewater to beyond bottled water quality, then allows it to percolate into the groundwater basin for later use as potable water. This system uses only about half the energy that would be required to transport that water from Northern California to Southern California.

Distribution

3. Fix Leaking Drinking Water Pipes

Water treatment processes use large quantities of energy to treat and distribute water to customers. Energy use for water treatment is expected to increase as more stringent water quality rules and improved disinfection technologies, such as ultraviolet treatment and ozonation, are put in place that reduce the risk of carcinogens and other potentially harmful disinfection by-products. Yet many drinking water systems lose as much as 20 percent of treated drinking water each year due to leaks in their pipe networks.[3] Improving drinking water infrastructure would save water and energy, and reduce the global warming pollution that results from wasted energy.

End Use

4. Promote and Expand the EPA's WaterSense Program

The Environmental Protection Agency (EPA) launched its WaterSense program in 2007 to help consumers and businesses identify products that meet the program's water-efficiency and performance criteria. The program sets specifications for the labeling of products that are at least 20 percent more efficient than the current standards while performing as well or better than their less-efficient counterparts. All water savings realized through the use of WaterSense-labeled products and services also have a corresponding reduction in energy consumption. The EPA estimates that if just one out of every 100 American homes were retrofitted with water-efficient fixtures, about 100 million kilowatt-hours of electricity per year would be saved—avoiding 80,000 tons of global warming pollution, or the equivalent of over 8 million gallons of gasoline consumption.

Local and federal government can expand and promote the WaterSense program by:

- Offering rebates for the purchase of WaterSense products, as some cities are already doing.
- Offering federal tax credits for purchasing WaterSense products, as for the Energy Star program.
- Requiring WaterSense products in new construction and in government buildings.

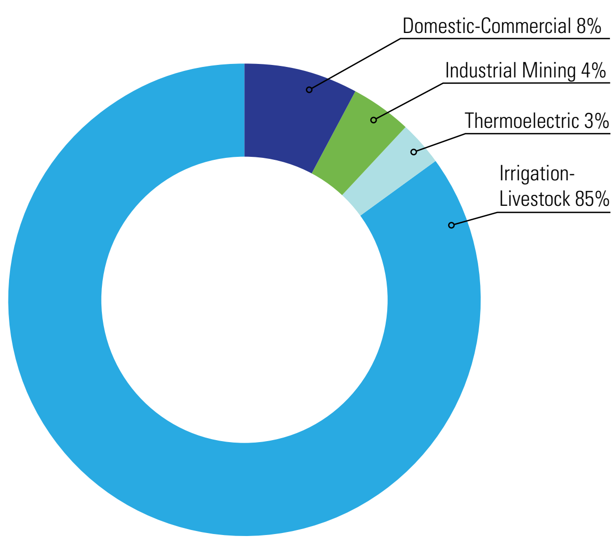
5. Require and Provide Incentives for Agricultural Water-Use Efficiency and Soil and Manure Management

Agriculture is a major user of groundwater and surface water in the United States, accounting for about 85 percent of the country's consumptive water use.

You Can Save Water and Energy with WaterSense

Consumers can save both water and energy costs by switching to WaterSense-labeled fixtures and appliances, including toilets, showerheads, faucets, clothes washers, dishwashers, and irrigation equipment. For instance, the average household could save more than 11,000 gallons of water, and about $170 on its water bill, every year by making a few simple changes such as installing WaterSense-labeled toilets and faucets in the bathroom. If just 1 percent of American homes replaced an older toilet with a new water efficient toilet, the country would save more than 38 million kilowatt-hours of electricity—enough electricity to supply more than 43,000 households for a month.[4]

U.S. Consumptive Water Use



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Water use efficiency measures such as modest crop shifting, smart irrigation scheduling, advanced irrigation management, and efficient irrigation technology have the potential of vastly improving water use efficiency. Switching from flood irrigation to drip irrigation, for instance, can increase water use efficiency as much as 40 percent. Even small management changes can bring a 10 to 15 percent improvement in water use efficiency. Less water pumped for agricultural purposes equals energy savings and global warming pollution reduction.

Global warming pollution can also be reduced by improved agricultural soil and manure management, which produces important water quality benefits as well. According to recent estimates, agriculture accounts for about 6 percent of all global warming pollution in the United States. Nitrous oxide is the most significant greenhouse gas emitted through agricultural production. Agricultural soil management activities account for 78 percent of nitrous oxide emissions, most of which result from the application of nitrogen fertilizers to cropland, which in turn causes water pollution. Currently, U.S. farmers apply about 20 to 30 percent more nitrogen fertilizer than needed. Scientists further estimate that reducing nitrogen fertilizer use would reduce downstream water pollution by more than 20 to 30 percent.[5] Proven nutrient conservation practices are available that can substantially reduce loss of nitrogen to the atmosphere and to surface and groundwater.

Wastewater and Drinking Water Treatment

6. Implement Energy Conservation Measures at Drinking Water and Wastewater Treatment Facilities

Facilities that treat and distribute drinking water and collect and treat wastewater have the potential to achieve 15 to 30 percent energy savings, or 15.75 to 31.5 billion kilowatt-hours, through energy conservation measures alone.[6] Technology is currently available to improve energy efficiency of equipment such as motors, drives, and fans, by up to 50 percent for some individual parts. Given that water and wastewater facilities are often the largest and most energy-intensive loads owned and operated by local governments, representing up to 35 percent of municipal energy use, water resources agencies and energy commissions should work together to reflect water-energy connections. For instance, the non-profit Consortium for Energy Efficiency has launched the National Municipal Water and Wastewater Facility Initiative, which brings together municipalities, counties, water districts or authorities, and townships to promote greater energy efficiency in publicly held facilities.

7. Retrofit Wastewater Facilities to Generate Energy from Capture and Use of Biogas

Another way to save energy in the water supply process is by retrofitting wastewater facilities with Combined Heat and Power (CHP) systems. CHP systems can recover biogas (a mixture of methane, carbon dioxide, water vapor, and other gases) from anaerobic digesters to heat buildings or to generate electricity. For example, San Francisco's East Bay Municipal Utility District captures and uses biogas to generate enough electricity to cover 90 percent of energy needed at its main wastewater facility. It is estimated that if all 544 large sewage treatment plants in the United States operating anaerobic digesters were to install CHP systems, about 340 megawatts of clean energy could be generated, offsetting 2.3 million metric tons of CO_2 emissions annually—equivalent to planting about 640,000 acres of forest, or the emissions of about 430,000 cars.[7]

Water Efficiency Saves Energy

U.S. cities, particularly those in the arid Southwest, continue to struggle to find fresh water. At the same time, these cities are on the front lines for feeling the impacts of global warming, such as higher temperatures and prolonged droughts. These water use efficiency measures can be implemented by consumers and agencies alike, saving both water and energy and mitigating global warming pollution. It is clearly a win-win solution.

1 EPA, *National Water Program Strategy: Response to Climate Change* (2008), at 24-25, at http://www.epa.gov/water/climatechange/strategy.html. Much of the information in this fact sheet has been adapted from this report.

2 U.S. Dept. of Energy, *Energy Demands on Water Resources* (2006), at 18, at http://www.sandia.gov/energy-water/docs/121-RptToCongress-EWwEIAcomments-FINAL.pdf.

3 Congressional Budget Office, *Future Investment in Drinking Water and Wastewater Infrastructure* (2002), at 8, at http://www.cbo.gov/ftpdocs/39xx/doc3983/11-18-WaterSystems.pdf.

4 EPA, WaterSense program website, at http://www.epa.gov/watersense/index.htm.

5 Millennium Ecosystem Assessment, *Ecosystems and Human Well-being: Policy Responses* (2003), at 302.

6 Consortium for Energy Efficiency, *Initiative Description: CEE National Municipal Water and Wastewater Facility Initiative* (2007), at 1, at http://www.cee1.org/ind/mot-sys/ww/ww-init-des.pdf.

7 EPA, Combined Heat and Power Partnership, *Opportunities for and Benefits of Combined Heat and Power at Wastewater Treatment Facilities* (2007), at iii, at http://www.epa.gov/chp/documents/wwtf_opportunities.pdf.